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Special schools or special classes are the prevalent vehicles of deviant behavior modification, although it is proposed here that effort should be first made to determine variables which influence behavior development and disturbance in the regular classroom. A need is seen to develop methods useful in regular classrooms to prevent or intervene in the development of behavior disorders. The present study evaluates the effects of token reinforcement, programed instruction, and Hawthorne-type social reinforcement, on the attending behavior and learning rates of behaviorally disruptive fourth-grade boys. Compared with a control group were four groups of boys. Token reinforcement in combination with programed learning was more effective than either treatment alone, or the Hawthorne effects treatment. Limitations are discussed in extending the methods or results to regular classroom use. (BP)

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INTERIM REPORT

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Accelerating Classroom Attending  
Behaviors and Learning Rate

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## CHAPTER I

### STATEMENT OF THE PROBLEM

During recent years there has been an increased effort on the part of the public schools to identify and treat children evidencing behavioral disturbances. This increase in interest and responsibility has been due, at least in part, to the high incidence of school age children with emotional problems, and the accumulating evidence of a close relationship between successful performance in school and satisfactory behavioral adjustment. A greater realization of the therapeutic potential of the school is resulting in responses to the need for special consideration of these children.

Prevalence studies, such as those conducted by Bowers (1958), and a study by the Department of Psychiatry at Columbia University (1957) indicate approximately ten per cent of the public school population to be emotionally maladjusted. Mackie and Dunn (1954) report approximately two per cent of school age children to be socially maladjusted. A study by Ullmann (1952) found that teachers identified eight per cent of their pupils as maladjusted. Wall (1955) cited eight investigators in which the incidence of behaviorally disturbed children ran from four to twelve per cent.

Facilities and specially trained personnel are not presently available to serve adequately the number of children needing help. A national survey by Zubin and Simson (1959) revealed that twenty-eight states do

not provide public facilities for the diagnosis and treatment of the disturbed child.

The public schools, in providing for the social and emotional well-being of children, must make available special services, but there is wide divergence of opinion as to the means of achieving their objectives. Birch (1956) surveyed ten major school systems having special classes and schools to gain information concerning current educational practices for children presenting behavior and/or personality problems. He found that the cities surveyed had more than one type of special school or class for maladjusted children. The most frequently used facility was the special school, with special classes in regular schools following. Bower (1959) visited fifteen facilities and projects to determine the prevailing facilities and trends with regard to the education of emotionally disturbed children. He concluded that the problem of educating emotionally disturbed children has become a critical one for the majority of school systems. In school systems where no planning or programming had been accomplished, the problem of the behaviorally maladjusted child in the system became more acute. Morse, Cutler, and Fink (1964) in a report of research findings based on a survey of all emotionally handicapped classes in the United States in 1962, conclude that there is as yet no consistency in the identification, objectives, or conduct of programs for behaviorally disturbed children.

Quay, et. al. (1966) recognized the need to extend principles of behavioral analysis and modification to the public school level when he suggested that:

"The economics of public schools require the development of techniques that will allow children to be handled in a group situation by as few adults as possible. Most of the techniques of behavioral remediation have been developed for use on an individual basis and it seems crucial at this stage to attempt to extend these techniques to group situations . . . behavior techniques . . . are likely to remain economically unfeasible unless they can be adapted for use in a group setting such as the classroom"

#### Purpose of the Study

The above discussion, regarding incidence, facilities, personnel, and the divergence of existing programs, indicates the need for some basic kinds of information about management of behaviorally disturbed children.

Rather than assume that special schools or special classes are a first step in an attempt to deal with the problems of these children, the author believes that behavioral disturbances should first be studied within the regular classroom. An effort should be made to determine the variables within that setting that influence behavioral and educational development. There appears to be a need, also, to develop methods which can be used by teachers within the regular classroom to prevent, or intervene in, the development of behavior disorders. These methods, hopefully, would not necessitate large expenditures of funds or require expensive facilities or large numbers of specially trained personnel.

Desired classroom behaviors are undoubtedly a function of many inter-related factors. The appropriateness of instruction to the student's level of functioning, and the reinforcers available to him for academic production are likely to be two important variables in the

development and maintenance of appropriate behaviors. Treatment programs are too often focused upon the undesired behaviors and their elimination, neglecting to make a thorough appraisal of the "setting" in which the behaviors originated or were maintained. Objectionable behaviors may be eliminated within the treatment setting, but unless provisions are made to insure the maintenance of appropriate behaviors within the referring setting the behaviors are likely to reappear.

Behavior that has been "paid off" in the classroom is more likely to recur. Students with inadequate academic skills usually receive little reward for their attempts at academic tasks. The reinforcers available through academic competence include: (A) the social reinforcement of teacher and peer responses to competency, and (B) those of master, the ability to solve problems, or "positive self-regard."

Lack of success with academic tasks not only reduces the availability of the above kind of rewards, but has at least two potentially negative effects on task-oriented, productive behavior, these being (A) that poor grades and ridicule may inhibit further academic attempts, and (B) that as preferred behavior decreases, it is likely that undesired behaviors will increase. (This is true by definition if non-participation is seen as undesirable.)

B. F. Skinner (1968) in a discussion of behavioral control in the lower grades says:

"It is part of the reform movement known as progressive education to make the positive consequences more immediately effective, but anyone who visits the lower grades of the average school today will observe that a change has been made, not from aversive to positive control, but from one form of

aversive stimulation to another. The child is at his desk, filling in his workbook, is behaving primarily to escape from the threat of a series of minor aversive events--the teacher's displeasure, the criticism or ridicule of his classmates, an ignominious showing in a competition, low marks, a trip to the office "to be talked to" by the principal, or a word to the parent who may still resort to the birch rod. In this welter of aversive consequences, getting the right answer is in itself an insignificant event, any effect of which is lost amid the anxieties, the boredom, and the aggressions which are the inevitable by-products of aversive control."

The purpose of this study is to evaluate the differential effects of several treatment processes on the (a) attending behavior and (b) learning rate of students identified as being behaviorally disturbed. Programed instruction provides reinforcement in that a student checks his own answer and achieves a form of automatic reinforcement. Skinner (1968) points out that in a typical classroom long periods of time may elapse before the student receives any knowledge of results. A long series of contingencies is needed to bring a student to competency in mathematical behavior. The teacher, he says, is seldom able to reinforce each step in the series.

Token reinforcement, which will be used within two of the treatment programs in the study, will be made available to students for appropriate classroom behaviors. A written program will insure the relative frequency of reinforcement as compared with the usual frequency of teacher-dispensed reinforcement. Conferences regarding the purpose and rationale behind the token-reinforcement programs will precede their use by the teachers. Supervision by the investigator throughout the study will insure their correct, consistent utilization.

### Definition of Terms

#### Programed Instruction

This is a method of presenting topical information in a series of sequential steps. It involves the controlled presentation of information, the response of the learner, immediate feedback of each response, and the reinforcement which enables the learner to progress from the familiar to unfamiliar material.

#### Positive Reinforcement

Any definable environmental event consequent upon or coincident with the termination of a response which can be demonstrated to increase the probability of that particular behavior is positive reinforcement.

#### Social Reinforcement

Social reinforcement is usually a matter of personal meditation. Social reinforcement utilizes attention, approval, affection, and submission. Negative social reinforcement is most often administered in the form of unconditioned stimuli, or of disapproval, contempt, ridicule, or insult.

#### Token Reinforcers

A token reinforcer is a generalized reinforcer. The most common example is money, which can be exchanged for a great variety of primary reinforcers. In education, grades and diplomas became token reinforcers, the ultimate reinforcement being that of prestige or esteem.

### Contingencies of Reinforcement

The relations between a behavior and the consequences of that behavior are the contingencies of reinforcement.

Interval reinforcement reinforces behavior at regular intervals. Interval reinforcement generates especially stable behavior. Ration reinforcement is obtained when the schedule of reinforcement depends on the subject's behavior, as when the student is only reinforced when he completes a specific amount of work.

### Attending Behavior

For behavior to be classified as Task-Oriented, the student must be completely involved in assigned work, or attending to class discussion or lecture.

### Non-Attending Behavior

For behavior to be classified as Non-Attending, the student may be involved in inappropriate peer interaction and/or inappropriate classroom behavior in the course of doing or completing a task. Examples of behavior are interrupting others, giving answers without being recognized, or answering in an obviously inappropriate manner. Other deviant behaviors are fighting, talking, facial grimaces, signals to peers, tapping of pencils, rulers, or banging of feet, and slamming books; wandering about the room, looking into space, and generally attending to stimuli other than the educational task.

### Hawthorne Effects

The increased enthusiasm and effort due to a group's knowing they are in an experimental, or special situation. This effect is named

after the Hawthorne plant of the Western Electric Corporation where it was first noted and is described in detail by Newcomb and Hartley (1958).

## CHAPTER II

### REVIEW OF RELEVANT LITERATURE

#### Interaction of Academic Competence and Behavioral Adjustment

Investigators have agreed that there is a relationship between academic achievement and behavioral adjustment. The problem is deciding how one influences the other, and in what order. The relationship between academic success and emotional adjustment is discussed by Bruckner and Bond (1955) who cite evidence from clinical and classroom experience and systematic research that indicates a close relationship between educational disabilities and adjustment, although they suggest that the character of the relationship is difficult to determine. Clinical workers in reports of marked educational disabilities cases tend to emphasize the role of adjustment problems. Although there is difference of opinion as to whether failure in educational learning is the cause or the result of emotional maladjustment, it is fairly well agreed that if a child is behaviorally disturbed, his educational progress will be impaired. Bruckner and Bond (ibid) say "...it can be expected that a child who is experiencing difficulty in such an important learning area as reading, upon which his success as a student depends, is likely to become confused and frustrated and to display emotional and social adjustment problems of one sort or another." Fernald (1943) studied the school histories of seventy-eight serious

reading disability cases handled by her clinic and reported that only four cases indicated emotional instability preceding the reading problem. She concluded that educational defect and its consequent feelings of confusion and frustration can lead to emotional maladjustment. Robinson (1946) concluded, after a study of twenty-eight cases, that the emotional maladjustment could be either the cause or result of reading disability. She considered emotional disturbances as a possible cause of reading failure in forty-three per cent of the cases studied. A longitudinal study by Sorenson (1950) tended to show that failure to achieve in reading upset the children and caused them to lose confidence. The teachers saw signs of increased emotional tensions among the poor readers. A study by Buswell (1950) indicated that a student's peers tend to reward academic competency. She found that when children are chosen to work on some topic, the choosing of a child by his peers depends to a great extent upon his ability to contribute to the group. Children of low reading ability preferred to work with those children of average reading ability, and those with average reading ability wanted to work with those children who had even greater reading skills.

Olson (1939) in his early study of academic achievement and emotional adjustment reported a substantial relationship between adjustment and achievement as rated by teachers.

Fitzsimens (1958) in a study of the value of teachers' referrals of emotionally disturbed children to a clinic reported that the instructions to refer any child who is failing academically led to the discovery of many seriously disturbed children who would not

otherwise have been detected.

An extensive study of emotionally disturbed fourth, fifth, and sixth grade children conducted by Bower (1955) indicated that the emotionally disturbed children were significantly below a control group of "normals" in academic achievement, although there was no statistically significant difference between the two groups on mean intelligence test scores.

#### Programed Instruction

The need for immediate feedback for instruction to be effective has been demonstrated repeatedly by Skinner (1959). In the typical classroom there are frequently extended periods between the students' response, and feedback, or reinforcement. Skinner has contended that children are seldom exposed to the precise contingencies needed to build subtle discriminations.

The problems of motivation and the problem of reinforcement are seen by Gagne and Belles (1959) as highly interrelated. Motivation is intrinsic when it depends upon the nature of the task, and relevant reinforcement is provided by giving the learner "knowledge of results." Conclusions of motivation reinforcement sequence studies indicate that reinforcement should be positive rather than negative. Lack of reinforcement may cause the learner's motivation to lag and fails to provide information he needs in order to learn.

Deterrents to teachers' assurance of consistence and direction is stated in Skinner's (1954) assumption that conditions in classroom

environments are accidental and lack precision primarily because teachers cannot effectively serve large groups of children at one time. Immediate and meaningful reinforcement is thought to be essential to avoid learning difficulties.

Programed instruction has been tried and has shown varying degrees of effectiveness from every level from preschool to graduate school. It has been used with slow learners by Smith and Quackenbush (1960) and by Stolurow (1961) who accomplished an average gain in arithmetic of .51 grade level, as measured by the California achievement test, in a group of retarded children (mean IQ 77) whose corresponding average gain during the previous year had been .19 grade level. Bijou's (1965) experimentation with programed instruction for retardates at the University of Washington provides evidence of the promise of this technique.

Pines (1964) describes the work of a Dr. Moore, a Yale sociologist in whose laboratory pupils learn to read, write, type, take dictation, and compose their own stories before they enter first grade. Dr. Moore attributes his success to his extensive research on culture, learning theory, and "higher order problem solving behavior." In one experiment, five retarded boys and girls who had been rejected by public kindergartens because of low IQ's and behavior problems, all had learned to read simple material after a year of work in the laboratory school.

Testing a spelling program in second and sixth grade classes, Porter (1959) found that in twenty-two weeks the group using the program learned significantly more than a comparable group taught by conventional

methods. There was no significant relation between IQ and amount of learning in the experimental group, but there was the usual relationship on the usual week-by-week basis, but the experimental group spent one quarter as much time studying as the control group.

Programed instruction has been used successfully to teach a wide variety of subject matter; mathematics and statistics, foreign language, spelling, natural science, psychology, library use, among many others that appear in the literature. Shram (1962) in discussing research and programed instruction points out that although comparisons with "conventional" methods of teaching are often suspect because of the suspicion that the "Hawthorne" effect of new methods and unusual attention, such comparisons have shown programed instruction to be a respectable educational development.

Birnbrauer, et al (1965) report findings in a classroom for retarded children in which programmed instruction methods and reinforcement principles were used for an entire academic year. Eight of their subjects demonstrated that they were capable of profiting from this method. A token reinforcement system was used to maintain studying and cooperation.

Mentally retarded children used programed instruction in arithmetic in a study by Johnson (1966). He compared gains in addition and subtraction skills through the use of conventional and programed instruction. His results suggested the use of programed instruction to be as effective, or more effective than the use of conventional teaching methods.

An investigation by Bradley and Hundziak (1965) attempted to evaluate the performance of fifteen mentally retarded children in the TMI Grolier Time Telling program presented on a teaching machine. The results of their study suggest that mentally retarded subjects can profit from a teaching machine program written for normal children.

#### Pertinent Studies on Behavior Modification

The principle of behavior modification revealed by Skinner have been widely demonstrated in the laboratory. Lately those principles have been used to modify the behavior of deviant children in group situations. The studies included here deal primarily with behavior modification with small groups in special settings.

O'Leary and Becker (1967), using a token reinforcement program reduced deviant behavior in eight disruptive children in a third grade adjustment class. The children received teachers' ratings which were exchanged for reinforcers such as candy and trinkets. Introduction to the token reinforcement program was followed by an abrupt reduction to the deviant behavior. Delay of reinforcement was gradually increased to four days without increase in deviant behavior. Anecdotal evidence suggested that the children's appropriate behavior generalized to other school situations.

Vallet (1966) suggests that so long as the child is a member of a class he is a member of a social system that can be utilized to control his behavior. Primary reinforcers have been found to be useful in eliciting responses and stimulating motivation. Primary rewards, they

feel, should be accompanied by verbal praise and occasional physical reinforcers. Vallet prescribes the use of tokens as immediate reinforcers to be exchanged later for primary reinforcers or social privileges.

The use of positive social reinforcement to eliminate tantrum behavior was reported by Zimmerman and Zimmerman (1962). The subjects were isolated during tantrum periods and given verbal praise and social privileges for appropriate behavior. They reported that there was no generalization to other tantrum behavior outside of the classroom setting.

A token reinforcement program reported by Tyler (1966) showed statistically significant results in the improvement of test performance of a group of institutionalized delinquent boys. The method employed the use of a television news program, on which the subjects were tested. Grades determined the number of tokens each subject received. Tokens were exchanged for candy, gum or other items.

In a report on the Arlington County Experiment, Haring and Whelan (1965) suggest the superiority of the structured classroom over the regular classroom. The treatment process used in this experiment includes a highly structured classroom environment. Correct behavioral responses are reinforced, and incorrect ones followed by the withholding of positive reinforcers. When a student completes a series of tasks, he is ready for a reinforcement period. Reinforcement sessions include a juice break, arts and crafts activities, free play time, gross motor training, and science activities. The process includes a stage in treatment when cognitions are developed by the child. By

cognitions, the author means that the child is developing an understanding of the relationship between his behavior and its consequences. By this stage subjects are operating almost completely on social reinforcement.

Mattos, Mattson and Walker (1967), in a study designed to develop strategies and methodologies that could be effectively employed by school personnel to meet the needs of behaviorally disturbed children found a combination of types of reinforcement to be effective. These included "free time" which students earned by demonstrating appropriate academic and social behavior. Free time, they suggest, has advantages as a reinforcing agent, since it allows each individual to choose the activity most reinforcing to him, and free time is a consequence more readily available than tangible reinforcers within the regular classroom setting. A group reinforcing procedure was also employed in this study. Reinforcement was made contingent upon the performance of all the members of the class. The group earned points which were exchanged for field trips. These investigators also found that withdrawal of positive reinforcement by removal of the child from the classroom for inappropriate behavior was highly effective.

An appraisal of methods by which maladaptive behavior may be replaced by adaptive alternatives is made in an article by Quay, Werry, McQueen and Spague (1966). They suggest that behavior may be changed by cuing the child through verbal instruction, the use of modeling or imitation, in which the child can observe appropriate models emitting the desired behaviors, or that of successive approximations, whereby

one rewards behaviors which, while below a desired standard, is within the capacity of a child in treatment. The goal is raised until the socially acceptable norm is achieved.

Azrin and Lindsley (1956) utilized operant conditioning techniques to develop, maintain, and eliminate cooperation between children from seven to twelve years of age, with children matched for age and sex. Cooperative responses gradually increased in frequency when reinforced and decreased gradually when not reinforced.

Social reinforcement was used by Hart, et al, (1964) to help children exhibiting a high rate of crying to acquire more effective behavior in stressful situations. The subjects were enrolled in a pre-school. Extinction of operant crying was instituted by instructing teachers to ignore the child's operant cries. Every time the child responded in a more appropriate manner in a stressful situation, he was to be given teacher attention and approval. The case studied presented by these authors indicated that the crying may have been largely a function of adult attention.

School phobia was eliminated in a seven-year-old boy by Patterson (1965) with the use of primary and social reinforcers. It was assumed by the author that the pairing of candy and social reinforcers would increase the value of social approval in the subject, who was initially unresponsive to social reinforcers. The procedure, involving the principles of interference and reinforcement resulted in a dramatic reduction in the school phobic behavior of the subject.

Patterson (1965) describes a technique for controlling the behavior of a hyperactive child in the classroom setting. Social and non-social reinforcers were used to increase a broad group of behaviors appropriate in the classroom setting of a nine-year-old boy. Conditioning was carried out during classroom activities varying from silent reading to arithmetic and class recitation. The results of the experiment support the idea that it is possible to manipulate behaviors occurring in the classroom setting. The author points out that there was no way to identify whether candy and pennies as reinforcers or social approval produced the effect.

The rehabilitation of a twelve-year-old girl's behavior, both socially and academically was reported by Dyer (1968). The individual program, using reinforcement principles, was carried out within a special classroom for behaviorally disturbed children. The author pointed out the importance of the teacher's observations and awareness of the child in designing the program to effect behavioral change.

## CHAPTER III

### METHODOLOGY

#### Design of the Study

The design of the study allows for the investigation of behavioral change in four groups under different treatment conditions. The results of the four treatments will be compared with the performance of a non-treated control group.

The independent variables that may affect treatment results are intelligence quotients, achievement scores, and Behavior Checklist scores. These variables will be subjected to analysis of covariance to determine their effects on treatment outcomes, or the dependent variable, attending behavior.

Academic rate change is reflected by the graphing of rate data from the pre-treatment and treatment periods.

A schema of the experimental design of the study appears below.

#### Experimental Design

| Treatment | Type of Intervention                     | Pre-Treatment |           |
|-----------|------------------------------------------|---------------|-----------|
| Yb        | Token Reinforcement                      | Ya            | Group I   |
| Yb        | Programed Learning                       | Ya            | Group II  |
| Yb        | Token Reinforcement & Programed Learning | Ya            | Group III |
| Yb        | Hawthorne Effects                        | Ya            | Group IV  |
| Yb        | No Intervention (control)                | Ya            | Group V   |

#### Independent Variables

$X_1$  - intelligence scores

$X_2$  - achievement scores

$X_3$  - behavioral checklist scores

#### Dependent Variables

$Y_1$  - attending behavior

$Y_2$  - academic rates

Intervention in the form of four treatment plans, include the following: I token reinforcement, II programed instruction, III token reinforcement/programed instruction, and IV a "Hawthorne effects" treatment employing planned "extra attention." The fifth group serves as a control.

The pre-treatment scores are the mean of a series of time-sample observations taken on each subject's behavior during the pre-treatment period.

The treatment scores are the mean of the time-sample observations of each subject's behavior during the treatment period.

The general design of the study compares (A) the classroom behavior of behaviorally disturbed fourth grade boys under four different treatment procedures with a group of control subjects, and (B) the differences in rate of computation of problems during the pre-treatment in treatment periods for the two groups using programed arithmetic.

The results of the study should provide evidence as to whether significant, positive changes can be made in the classroom behavior of behaviorally disturbed fourth grade boys by treatment methods that can be employed within the regular classroom by elementary school personnel.

The following hypotheses, stated in null form are tested:

1. There will be no statistically significant differences between levels of attending behaviors in groups I, II, III, IV or V during the pre-treatment period.
2. No statistically significant differences will occur between the pre-treatment and treatment levels of attending behavior for each experimental group.
3. There will be no statistically significant differences between the treatment means of attending behaviors of groups I, II, III and IV and that mean of the control group when IQ's are covaried.
4. There will be no statistically significant differences between the treatment means of attending behaviors of groups I, II, III, and IV and that mean of the control group when behavior checklist scores are covaried.
5. There will be no statistically significant differences between the treatment means of attending behaviors of groups I, II, III and IV and that mean of the control group when arithmetic computation achievement scores are covaried.
6. There will be no statistically significant differences between the treatment mean of attending behavior of groups I, II, III and IV

and that mean of the control group, when initial differences in attending behavior are covaried.

### The Sample

The sample consisted of fourth grade boys from the Eugene, Oregon, School District #4. The sample was drawn from five elementary schools selected by school administrative personnel. The study involves a total of twenty-five children. They are of average intelligence, but academically retarded in arithmetic computation by at least one year as indicated by achievement test scores. The subjects' deviant behaviors were identified by classroom teachers through the use of a Behavior Checklist (Walker, 1967). Teachers in the selected elementary schools were asked to identify the five most behaviorally disruptive, under-achieving fourth grade boys in their building. The teachers completed Behavior Checklists on each nominated student. Achievement data, also recorded by the teachers, were taken from the Arithmetic Computation subtest of the Standard Achievement Test. Intelligence quotients, recorded by the teachers and the experimenter, were the results yielded by the California Test of Mental Maturity. One of the treatment strategies was assigned to the five subjects selected in each of the separate schools.

### Assessment and Data Collection Instruments

The Behavior Checklist developed by Walker (1967) consists of fifty descriptive statements of overt, deviant behaviors. The

FIGURE I

Summary Description of Sample  
and Effects of Treatment on Attending Behavior

|     | Group                                            | Subject | Arithmetic<br>Achievement<br>Score | Age  | Behavior<br>Checklist<br>Score | IQ  |
|-----|--------------------------------------------------|---------|------------------------------------|------|--------------------------------|-----|
| I   | Token<br>Reinforce-<br>ment Group                | 1       | 3.3                                | 9-11 | 21                             | 108 |
|     |                                                  | 2       | 2.9                                | 9-8  | 40                             | 85  |
|     |                                                  | 3       | 3.7                                | 9-11 | 31                             | 101 |
|     |                                                  | 4       | 3.7                                | 10-1 | 19                             | 99  |
|     |                                                  | 5       | 3.1                                | 9-10 | 6                              | 112 |
| II  | Programed<br>Learning                            | 1       | 2.9                                | 9-11 | 15                             | 115 |
|     |                                                  | 2       | 2.7                                | 9-8  | 8                              | 102 |
|     |                                                  | 3       | 2.1                                | 10-1 | 3                              | 103 |
|     |                                                  | 4       | 2.9                                |      | 21                             | 98  |
|     |                                                  | 5       | 2.7                                | 9-7  | 5                              | 107 |
| III | Token<br>Reinforcement/<br>Programed<br>Learning | 1       | 3.6                                | 10-1 | 22                             | 104 |
|     |                                                  | 2       | 3.0                                | 10-4 | 37                             | 99  |
|     |                                                  | 3       | 3.6                                |      | 17                             | 106 |
|     |                                                  | 4       | 1.9                                |      | 3                              | 103 |
|     |                                                  | 5       | 2.9                                |      | 20                             | 110 |
| IV  | Hawthorne<br>Effects                             | 1       | 3.4                                | 9-3  | 23                             | 106 |
|     |                                                  | 2       | 2.9                                | 9-9  | 32                             | 107 |
|     |                                                  | 3       | 3.5                                | 10-1 | 29                             | 97  |
|     |                                                  | 4       | 3.5                                | 10-1 | 14                             | 98  |
|     |                                                  | 5       | 3.1                                |      | 28                             | 101 |
| V   | Control<br>Group                                 | 1       | 3.4                                |      | 15                             | 115 |
|     |                                                  | 2       | 3.1                                |      | 15                             | 86  |
|     |                                                  | 3       | 2.7                                |      | 13                             | 97  |
|     |                                                  | 4       | 3.3                                |      | 14                             | 82  |
|     |                                                  | 5       | 3.7                                |      | 13                             | 97  |

instrument was designed for use by elementary teachers, and consists of observable, operational statements about behavior which were provided by a representative sample of elementary teachers. The Checklist serves as an aid to the teacher in structuring her thinking in the difficult task of selecting children with behavior problems who may need to be referred to some supportive service.

The split-half reliability coefficient obtained on the scale is .985. Validity estimates are all statistically significant. Contrasted groups validity between experimental and control subjects is significant beyond the .001 level of confidence. A biserial correlation between test score and the criterion yields a  $r_{bis}$  of .68. The standard error of this correlation is .039, and its predictive efficiency is .33. The mean item validity is .40 with a Standard Deviation of .02. Forty-three items are statistically significant at the .05 level, and four are not statistically significant. The author of the checklist reports that with a minimal investment of teacher time, behaviorally disturbed children can be identified.

A time sampling technique which measures task-oriented behavior through a behavior observation form served to establish the per cent of time spent in task-oriented behavior by each subject during the daily arithmetic period. This is a sensitive and reliable measure of the status of behavior. Independent observers used the observation form to collect time samples of behavior during the two phases of the study. Data was collected on subjects during a pre-treatment baseline period, and during the treatment period.

Observations cover a ten minute period. Each observation period is divided into sixty ten second intervals. Subject behaviors are recorded as they occur during each ten second interval. The behavioral observations in this study fall into two categories: (1) task-oriented and (2) non-task oriented. Walker (1967) reports this type of behavioral observation method to be a sensitive measure of deviant and non-deviant student behaviors. He points out that the job of assessing changes in behavior has been complicated by problems of precision and sensitivity of measurement processes. Traditional assessment instruments designed for use in educational settings define behavior in terms of subjective, clinical symptoms. Inter-rater reliability coefficients between observers on clinical descriptions are usually low because of lack of agreement on which feeling states are represented by particular clinical symptoms. Subjective rating of behavior do not assess subtle effects of a treatment process upon behavior, as does a time-sampling technique.

Observers received training in the use of the time-sample-behavior observations through the use of a training film developed within the Engineered Learning Project, USOE Grant No. OEG 4-6-061308-0571. Inter-rater agreement was obtained by measuring agreement of observers on time samples of the filmed behavior of subjects in the Project classroom.

Learning Rate Data

Rate was collected in a pilot study which yielded a ratio between the number of "traditional" and the number of TMI Grolier Programmed Multiplication problems that students could complete in the same time interval. Five boys in the Engineered Learning Project class were told that they could earn a penny for each problem completed correctly on a set of problems essentially like those in the computation sections of the SRA Greater Cleveland Math Program textbooks being used in the Eugene Schools. The minutes it took each student to complete the set of problems was recorded. Each boy was then told he could earn a penny for every problem completed correctly in a programmed arithmetic textbook. Each student worked in the programmed text for the same number of minutes that it had taken him to complete the worksheet. The problems were comparable in that both were simple multiplication. A mean ratio of 2.1 traditional problems completed for each programmed response was obtained.

Table I

Pilot Study Results Showing Number of Traditional Multiplication Problems and Programed Multiplication Programs Completed in the Same Interval by Five Students Grades Four and Six

| N = (5) |         |                             |                           |          |
|---------|---------|-----------------------------|---------------------------|----------|
| Subject | Minutes | Number right<br>Traditional | Number right<br>Programed | Ratio    |
| 1       | 15      | 54                          | 22                        | 2.4      |
| 2       | 6       | 80                          | 33                        | 2.4      |
| 3       | 6       | 77                          | 45                        | 1.7      |
| 4       | 11      | 59                          | 24                        | 2.4      |
| 5       | 8       | 82                          | 48                        | 1.7      |
|         |         | Mean 70                     | Mean 34                   | Mean 2.1 |

Subjects selected fell approximately one year below grade level in the arithmetic computation sub-test.

#### Treatment of Data

Analysis of covariance will be used to determine whether differences between the means of the treatment groups are statistically significant. Analysis of covariance allows the comparison of groups that are initially unlike. Since the behavior of the subjects in each group is to be assessed by an instrument which is highly sensitive to small differences in behavior, equivalent groups are not likely to be obtained. Garrett (1966) points out the advantages of covariance to behavioral scientists when for various reasons it is impossible or difficult to equate control and experimental groups. Through covariance

analysis the experimenter is able to make adjustments in final scores which will allow for differences in an initial variable. Group means obtained from the pre-treatment baseline period and the treatment period were subjected to analysis of covariance to determine whether there are significant differences as a result of the treatment process. The relation of achievement, intelligence, and Behavior Checklist scores to treatment results is also obtained through covariance analysis.

Significance of differences between pre-treatment means and treatment means for each group are determined through the use of a correlated t-test.

Time-sample data is used to construct individual profiles on the behavior of each subject. These grades show, in a vivid manner, the per cent of task-oriented behavior displayed by each student during the two phases of the study.

Learning rate, or number of problems completed correctly, is graphed for groups II and III during the two phases of the study.

#### Treatment Procedures

Treatment programs I, II, III, and IV are designed to make reinforcement for academically-oriented behavior more available to each student. The effectiveness of each treatment should be evident in the time-samples of behavior and rate data. The treatment strategies will use I token reinforcement, II programed instruction, III programed instruction in conjunction with token reinforcement, and IV a "Hawthorne

effects" group which will receive a very generalized show of attention by members of the behavior-observation team, which will be no more than an expressed interest in these students' academic progress.

Token Reinforcement: Group I

The token reinforcement treatment plan will make available rewards in the form of "check marks," which may be exchanged for tangible reinforcers. The schedule here employed is a combined interval-ratio schedule. The receipt of tokens will be contingent upon the participation by the student in academically productive, classroom-appropriate behaviors. The tokens are to be dispensed by the classroom teacher when:

- (1) a student completes an assignment, with the degree of accuracy that is commensurate with class standards,
- (2) a student participates in a constructive way in a group math discussion period,
- (3) a student engages in no distractive or disruptive behavior during the mathematics period.

He may receive a check for one or all of these behavior dimensions at the end of the arithmetic period.

Programed Instruction: Group II

The second treatment group is to be supplied with programed arithmetic which will be used in place of the regular classroom mathematics materials, for use during the daily arithmetic period. TMI

Grolier (Teaching Machine Incorporated) Multiplication, booklet form will be used. This program is available for use in a teaching machine, but has been found to be less convenient and economical than the programmed text when used in the Engineered Learning Project classroom (Walken, 1968). These are linear programs which develop and strengthen basic computational arithmetic skills.

Token Reinforcement/Programed Instruction: Group III

The third treatment group will receive the combined treatments of group I and II. Since programed instruction is not assigned on the basis of a specified amount of work to be done, checks will be awarded for working on the materials for the duration of the computation portion of the arithmetic period.

"Hawthorne Effects": Group IV

The social reinforcement students may receive from the extra attention and interest that are the inevitable side effects of classroom research may be evaluated through the use of the "Hawthorne effects" group. The subjects will be observed on the same schedule as the other groups. The observer will merely indicate an interest in the student and his work with a few brief comments before beginning the observation period. If this treatment is sufficient to bring about significant behavioral change, this information is vital to the meaning of the study.

Controls: Group V

The subjects serving in the control group will be observed on the same schedule as the members of the treatment groups. There will be no interactions with the students, and the teacher will be informed only that they are serving as controls for the study.

Specific directions to teacher for Token Reinforcement Group I to carry out the interval-ratio schedule of reinforcement for desired behaviors:

(1) Five points may be given a student at the end of the class period for completing an assignment at a level of accuracy expected by the teacher.

(2) Five points may be given a student at the end of a period for making a constructive contribution to class discussion.

(3) Five points may be awarded a student for not causing any disruptions during an arithmetic period, even though he doesn't contribute to discussion or complete his assignment.

A student may earn, during any one arithmetic period, as many as fifteen points. These he can exchange for money or "prizes" when he has earned the amount he needs. The prizes available to the students included such articles as kites, softballs, model cars, marking pens, and money. The points represented one cent each toward the "purchase" price of any article. Therefore, if a student wanted immediate pay-off, he could, in one or two days, earn a kite, or pen, through appropriate

behavior. Or, he could, by saving for a period of several weeks, earn one of the more valuable prizes.

Teacher directions - Group II. Programed Instruction

Programed instruction will be used by the subjects in this group throughout the arithmetic period. A brief survey of the student's progress in the program would provide information about the appropriateness of the difficulty level of the program. The teacher merely told the students that the material was selected to help them, and that the students were to use it during a specified time period each day.

Teacher directions - Group II, Programed Instruction/Token Reinforcement:

The students using programed instruction will attend a classroom discussion but will work in the TMI Grolier program during the time that the class is doing computational work.

Token reinforcement will be dispensed on the same basis as in Group I.

Observer Directions - Group IV, "Hawthorne Effects"

The members of the observation team, upon entering a child's classroom, will quietly approach the student to be observed to make a statement that will indicate an interest in the student's academic progress.

The following phrases may be used by the observers:

- (1) Today's assignments looks interesting.
- (2) How are you doing on your assignment today?
- (3) This math looks interesting. Do you mind if I look at your work?
- (4) Well, this is different (same) than your work yesterday.

Group V - Control

The subjects in the control group will continue to work in regular materials with no changes in their daily routine except that they will be observed on the same schedule as the subjects in the treatment group.

## CHAPTER IV

### RESULTS OF THE STUDY

The purpose of the study was to determine whether or not several treatment processes would increase the (A) attending behavior and (B) learning rate of behaviorally disruptive, underachieving fourth grade boys. Analysis of covariance and the paired t-test are used to test the statistical significance of treatment results.

#### Measurement of Behavioral Change

##### Data Recording

Table II presents Inter-Rater agreement data, which are the results of an observer training session.

Table II

Results of a Training Procedure in Obtaining  
Inter-Observer Agreement in the Recording of Behavior

| Observers                                | Trial #1 | Trial #2 | Trial #3 |
|------------------------------------------|----------|----------|----------|
| Per cents of Agreement with Experimenter |          |          |          |
| #1                                       | .60      | .90      | .80      |
| #2                                       | .70      | .87      | .77      |
| #3                                       | .76      | .60      | .77      |
| #4                                       | .56      | .77      | .83      |
| #5                                       | .63      | .83      | .83      |
| #6                                       | .66      | .73      | .73      |
| #7                                       | .66      | .70      | .83      |
| #8                                       | .73      | .80      | .70      |
| #9                                       | .70      | .70      | .96      |
| Mean                                     | .66      | Mean .76 | Mean .80 |

Observers were trained to use the time-sample observation form through the use of a training film, developed by the Engineered Learning Project (ELP), Grant No. OEG 4-6-061308-0571.

The observer-trainees and the writer simultaneously viewed the film of ELP students, each using a time-sample observation form to record the behavior of the same individual.

Three agreement checks were performed. Discussion of behaviors and the appropriate recording of those behaviors followed the first two trials. A mean inter-rater-agreement coefficient of .66 was obtained in the first trial, .76 in the second trial, and .80 in the third trial. A per cent-agreement method, wherein the number of agreements each trainee had with experimenter's observations was divided by the number of possible agreements, produced these mean values.

#### Treatment Effects

The six hypotheses to be tested are restated below, each immediately followed by an analysis of the results pertinent to that hypothesis.

The accepted level of significance for the results is .05.

Hypothesis I. There will be no statistically significant differences between levels of attending behaviors in groups I, II, III, IV or V during the pre-treatment period.

Table III

#### Analysis of Variance of Baseline Data

| Source of Variation | df | SS     | MS    | SD    | F    |
|---------------------|----|--------|-------|-------|------|
| Among Means         | 4  | 892.8  | 223.2 |       |      |
| Within Groups       | 20 | 1741.9 | 87.1  | 9.328 | 2.55 |
| Total               | 24 | 2634.7 |       |       |      |

F at .05 = 2.87

The null hypothesis is accepted. The analysis of variance test does not yield statistically significant results. Differences in baseline period means approach but do not reach significance at the .05 level.

Hypothesis 2. No statistically significant differences will occur between the pre-treatment and treatment levels of attending behaviors for each experimental group.

Table IV

Paired t-test for Significant Differences  
Between Baseline and Treatment Means

N = (25)

| Group | N | Baseline Mean | Treatment Mean | Mean Difference | Critical Ratio |
|-------|---|---------------|----------------|-----------------|----------------|
| I     | 5 | 60.6          | 90.2           | 29.6            | 6.78**         |
| II    | 5 | 67.4          | 79.0           | 11.6            | 2.85*          |
| III   | 5 | 55.2          | 84.4           | 29.2            | 7.40**         |
| IV    | 5 | 54.2          | 62.6           | 8.4             | 1.34           |
| V     | 5 | 68.6          | 59.8           | -8.8            | 1.45           |

Difference needed for significance at the .05 level = 2.78  
Difference needed for significance at the .01 level = 4.60

\*\* Significant at .01 level

\* Significant at .05 level

Hypothesis 2 is rejected for groups I, II, and III. It is accepted for groups IV and V.

The paired t-test for significance of the difference between Treatment and Baseline means yielded differences significant at the .01 level for groups I (token reinforcement) and III (token reinforcement/programed arithmetic). It yielded a difference significant at the .05 level for Group II (programed arithmetic). It did not result in significant differences for Group IV (Hawthorne effects) or V, the control group.

Hypothesis 3. There will be no statistically significant differences between the treatment means of attending behavior of groups I, II, III and IV and that mean of the control group, when intelligence is covaried. Hypothesis 3 was rejected for treatment groups I, II and III, but was accepted for treatment group IV.

Through the analysis of covariance adjustments were made in the treatment means of attending behavior which allowed for initial differences in intelligence quotients among all subjects. Statistically significant differences resulted between the adjusted means of groups I, II, and III and the control group's means with intelligence covaried. Differences were significant at the .01 level.

There was not a significant difference between the treatment mean of group IV and the control group mean.

Table V

## Analysis of Covariance

Factor X is I.Q.

N = (25)

|               | df | SS       | MS      | Fy.x   | SD    | Semy.x | SED  |
|---------------|----|----------|---------|--------|-------|--------|------|
| Among Means   | 4  | 3184.371 | 796.092 |        |       |        |      |
| Within Groups | 19 | 1269.967 | 66.840  | 11.910 | 8.124 | 3.64   | 5.12 |

|                       |                                                                  |  |  |  |  |  |  |
|-----------------------|------------------------------------------------------------------|--|--|--|--|--|--|
| F at .05 level = 2.90 | Significant Difference at .05 level = $2.09 \times 5.12 = 10.70$ |  |  |  |  |  |  |
| F at .01 level = 4.50 | Significant Difference at .01 level = $2.86 \times 5.12 = 14.64$ |  |  |  |  |  |  |

| Adjustment for differences in X means |   |         |        | Differences Between Experimental and Control |         |  | Means    |
|---------------------------------------|---|---------|--------|----------------------------------------------|---------|--|----------|
| Groups                                | N | Mx      | MY     | Adjusted MY                                  | Group   |  |          |
| I                                     | 5 | 101.000 | 90.200 | 90.303                                       | I & V   |  | 29.280** |
| II                                    | 5 | 105.000 | 79.000 | 78.304                                       | II & V  |  | 17.231** |
| III                                   | 5 | 104.000 | 84.400 | 33.824                                       | III & V |  | 22.801** |
| IV                                    | 5 | 101.800 | 62.600 | 62.544                                       | IV & V  |  | 1.521    |
| V                                     | 5 | 95.400  | 59.800 | 61.023                                       |         |  |          |

\*\* Significant at .01 level

Hypothesis 4. There will be no statistically significant difference between the treatment means of attending behavior of groups I, II, and IV and that mean of the control group, when Behavior Checklist scores are covaried.

Table VI

## Analysis of Covariance

## Factor X is Behavior Checklist Scores

N = (25)

|               | df | SS       | MS      | Fy.x   | SD    | SEmy.x | SED  |
|---------------|----|----------|---------|--------|-------|--------|------|
| Among Means   | 4  | 3677.672 | 919.418 |        |       |        |      |
| Within Groups | 19 | 1232.262 | 64.855  | 14.176 | 8.050 | 3.609  | 5.72 |

F at .05 level = 2.90      Significant Difference at .05 level =  $2.09 \times 5.72 = 11.95$ F at .01 level = 4.50      Significant Difference at .01 level =  $2.86 \times 5.72 = 16.36$ 

## Adjustment for differences in X means

| Groups | N | Mx     | MY     | Adjusted MY | Differences Between Experimental and Control |  | Means    |
|--------|---|--------|--------|-------------|----------------------------------------------|--|----------|
|        |   |        |        |             | Group                                        |  |          |
| I      | 5 | 23.400 | 90.200 | 91.343      | I & V                                        |  | 32.621** |
| II     | 5 | 10.400 | 79.000 | 77.071      | II & V                                       |  | 18.349** |
| III    | 5 | 19.800 | 84.400 | 84.693      | IV & V                                       |  | 25.971** |
| IV     | 5 | 25.200 | 62.600 | 64.169      | IV & V                                       |  | 5.447    |
| V      | 5 | 14.000 | 59.80  | 58.722      |                                              |  |          |

\*\* Significant at .01 level

Hypothesis 4 was rejected for groups I, II and III, and accepted for group IV.

With differences in Behavior Checklist scores allowed for by the analysis of covariance, statistically significant differences were again obtained between the treatment means of attending behavior of groups I, II, and III and the control group mean. Differences were significant at the .01 level. Significant differences were not obtained between the treatment mean of group IV and the control group mean.

Hypothesis 5. There will be no statistically significant differences between the treatment means of attending behaviors of groups I, II, III and IV and that mean of the control group, when arithmetic achievement scores are covaried.

Table VII

Analysis of Covariance

Factor X is Arithmetic Achievement Scores, Computation Subtest

| N = (25)      |    |          |         |        |       |        |
|---------------|----|----------|---------|--------|-------|--------|
|               | df | SS       | MS      | Fy.x   | SD    | SEmy.x |
| Among Means   | 4  | 3615.289 | 903.822 |        |       |        |
| Within Groups | 19 | 1270.948 | 66.892  | 13.512 | 8.124 | 3.64   |
|               |    |          |         |        |       | 5.12   |

F at .05 level = 2.90      Significant Difference at .05 level =  $2.09 \times 5.12 = 10.70$

F at .01 level = 4.50      Significant Divverence at .01 level =  $2.86 \times 5.12 = 14.64$

Adjustment for differences in X means

|        |   |       |        | Differences Between Experimental and Control |                      |
|--------|---|-------|--------|----------------------------------------------|----------------------|
| Groups | N | Mx    | My     | Adjusted MY                                  | Group Means          |
| I      | 5 | 3.340 | 90.200 | 91.304                                       | I & V    31.662 **   |
| II     | 5 | 2.660 | 79.000 | 77.422                                       | II & V    17.775 **  |
| III    | 5 | 3.000 | 84.400 | 84.163                                       | III & V    24.521 ** |
| IV     | 5 | 3.280 | 62.600 | 63.467                                       | IV & V    3.825      |
| V      | 5 | 3.020 | 59.800 | 59.642                                       |                      |

\*\* Significant at .01 level

Hypothesis 5 was rejected for groups I, II, and III. It was accepted for group IV.

Differences between treatment means of attending behaviors of groups I, II and III and that mean of the control group were statistically significant at the .01 level when arithmetic achievement scores were covaried. The treatment mean of group IV did not differ significantly from that control group mean.

Hypothesis 6. There will be no statistically significant differences between the treatment means of attending behavior of groups I, II, III and IV and that mean of the control group, when initial differences in attending behavior are covaried.

TABLE VIII

Analysis of Covariance  
Factor X is Baseline Data

| N = (25)                                                                               |    |          |         |             |                                                          |           |
|----------------------------------------------------------------------------------------|----|----------|---------|-------------|----------------------------------------------------------|-----------|
|                                                                                        | df | SS       | MS      | Fy.x        | SEmy.x                                                   | SED       |
| Among Means                                                                            | 4  | 3772.783 | 930.348 |             |                                                          |           |
| Within Groups                                                                          | 19 | 1184.630 | 62.348  | 13.927      | 3.540                                                    | 4.974     |
| F at .05 level = 2.90      Significant Difference at .05 level = 2.09 x 4.974 = 10.396 |    |          |         |             |                                                          |           |
| F at .01 level = 4.50      Significant Difference at .01 level = 2.86 x 4.974 = 14.227 |    |          |         |             |                                                          |           |
| Adjustment for differences in X means                                                  |    |          |         |             |                                                          |           |
| Groups                                                                                 | N  | Mx       | My      | Adjusted MY | Differences Between Experimental and Control Group Means |           |
| I                                                                                      | 5  | 60.600   | 90.200  | 90.345      | I & V                                                    | 32.356 ** |
| II                                                                                     | 5  | 67.400   | 79.000  | 77.483      | II & V                                                   | 19.493 ** |
| III                                                                                    | 5  | 55.200   | 84.400  | 85.867      | III & V                                                  | 27.877 ** |
| IV                                                                                     | 5  | 54.200   | 62.600  | 64.312      | IV & V                                                   | 6.322     |
| V                                                                                      | 5  | 68.600   | 59.800  | 57.990      |                                                          |           |

\*\* Significant at .01 level

Hypothesis 6 is rejected for groups I, II and III. It is accepted for group IV.

When differences in initial attending behavior are allowed for, the means of groups I, II and III differ from the control group mean at the .01 level of significance.

The adjusted mean of attending behavior of group IV does not differ significantly from the control group mean.

Table IX

Pre-Treatment and Treatment Means of Attending Behavior for Each Subject by Groups

| Group               | I  | II | III | IV | V  |
|---------------------|----|----|-----|----|----|
| Pre-Treatment Means | 52 | 55 | 71  | 46 | 75 |
|                     | 47 | 68 | 46  | 71 | 58 |
|                     | 61 | 89 | 49  | 51 | 66 |
|                     | 66 | 55 | 61  | 50 | 75 |
|                     | 77 | 70 | 49  | 53 | 69 |
| Treatment Means     | 88 | 63 | 90  | 71 | 67 |
|                     | 89 | 74 | 84  | 64 | 68 |
|                     | 91 | 91 | 78  | 47 | 59 |
|                     | 85 | 79 | 83  | 69 | 47 |
|                     | 98 | 88 | 87  | 62 | 58 |

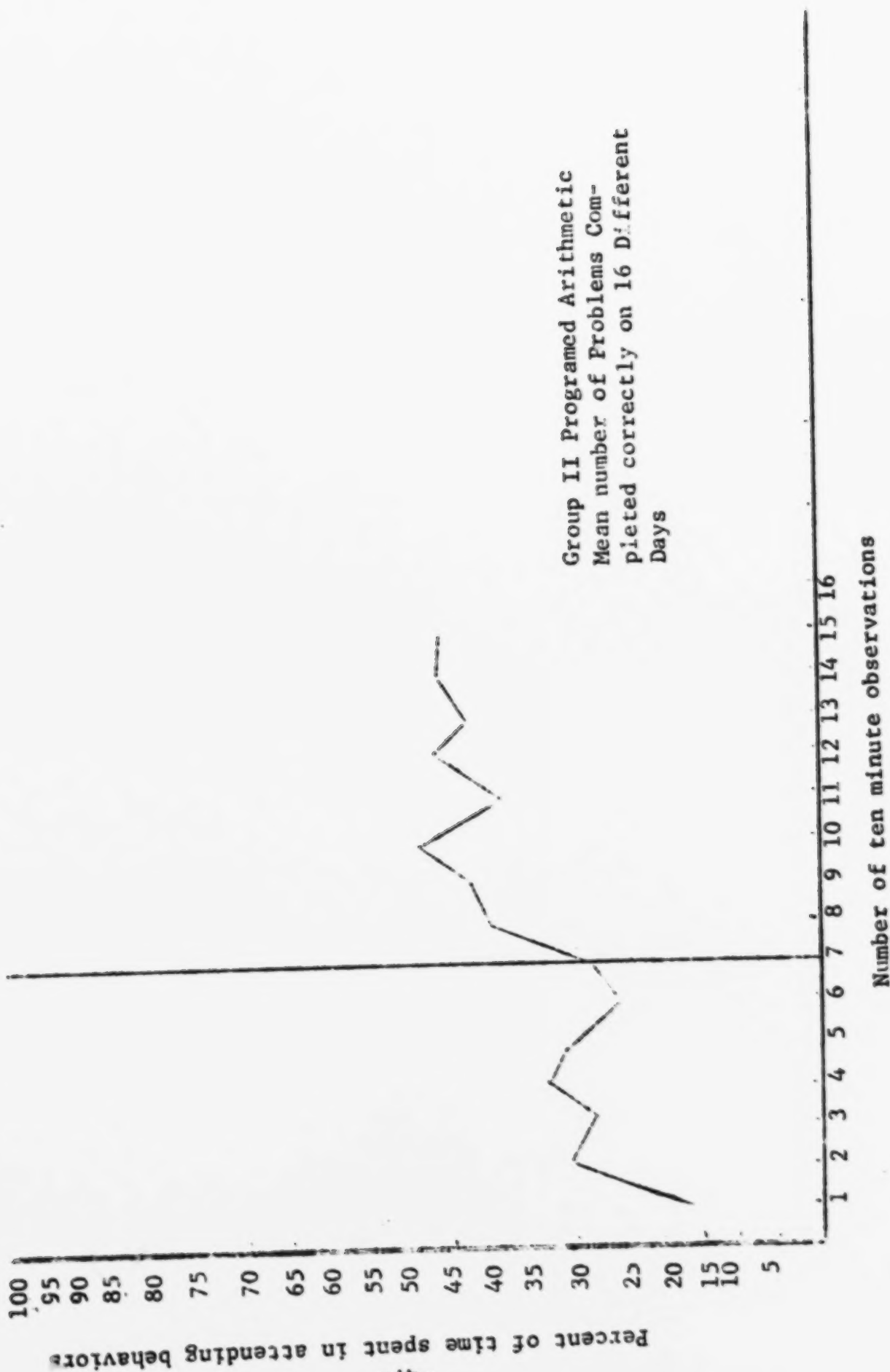
The mean changes in the percent of time engaged in attending behaviors in each group are as follows: Group I increased by 29.6 points, Group II by 11.6 points, Group III by 8.4 points, and Group V, the control, showed a change of 8.8 points, in a negative direction.

Learning Rate Data

The two graphs on the following pages illustrate the increase in the number of problems completed correctly on separate days. Limitations in the validity of the data are detailed in chapter five.

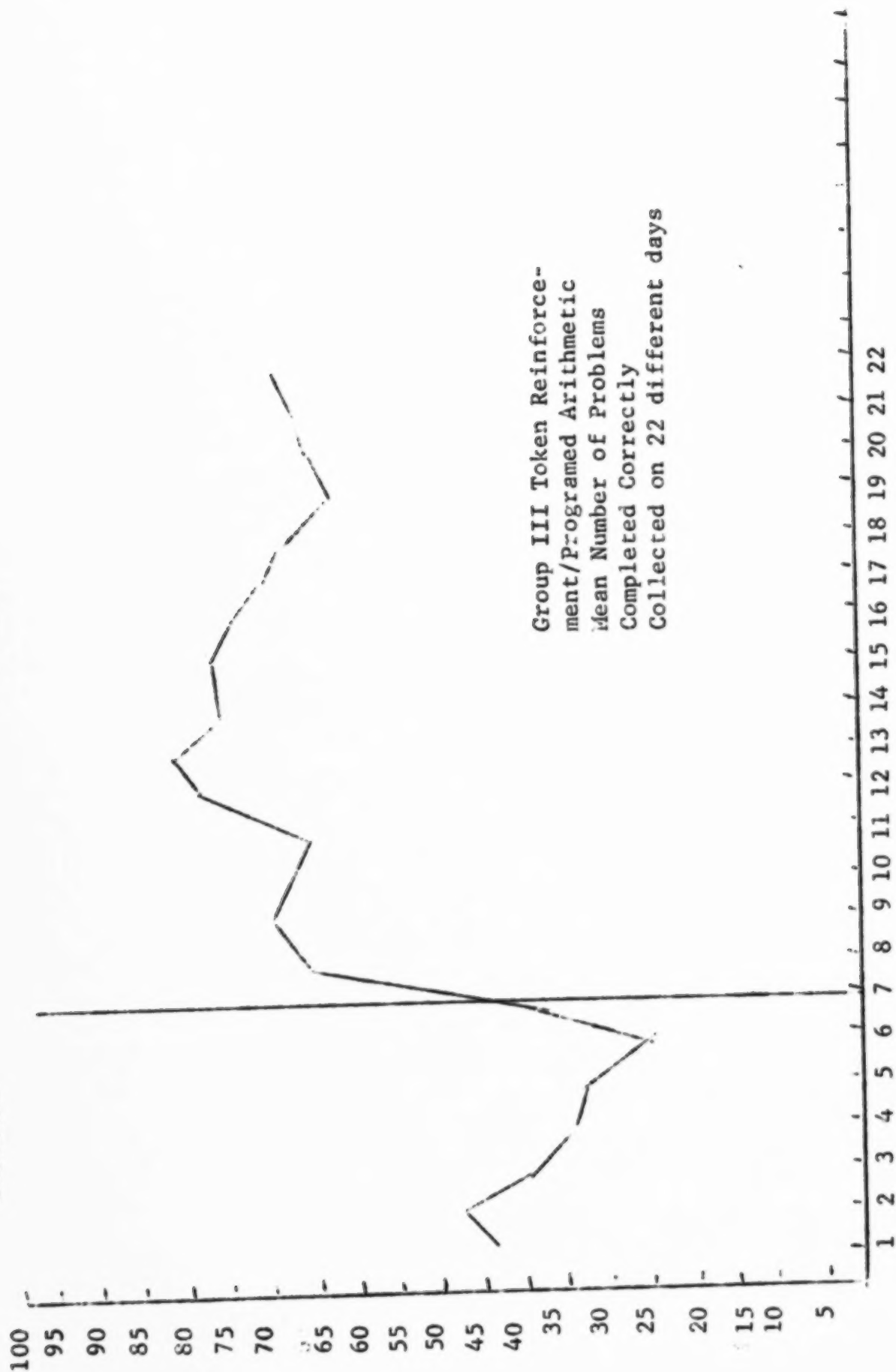
Treatment

Baseline



Treatment

Baseline



Group III Token Reinforce-  
ment/Programed Arithmetic  
Mean Number of Problems  
Completed Correctly  
Collected on 22 different days

Number of ten minute observations

## CHAPTER V

### DISCUSSION, CONCLUSIONS, SUMMARY, AND IMPLICATIONS FOR FURTHER RESEARCH

#### Purpose and Methodology

This study was designed to evaluate the effects of several treatment procedures on the attending behaviors and learning rates of behaviorally disruptive, underachieving fourth grade boys. Research was cited that indicated a need for methods of controlling and changing behavior that might economically be employed within the regular classroom.

The treatment procedures tested involved the use of token reinforcement, programmed instruction, and a Hawthorne effects treatment, which provided planned, if minimal, social reinforcement.

The efficiency with which each treatment process increased the rate of attending behavior was measured by a time-sample observation procedure, which is a sensitive measure of behavioral change. Changes in learning rate were determined by counting the number of problems completed correctly by each subject in groups II and III through the baseline and treatment phases of the study.

The general design of the study compared four groups of subjects under different treatments with a group of control subjects. A paired t-test was used to test for significance between baseline and

treatment means of attending behavior for each group. Analysis of covariance tested for statistically significant differences between treatment groups and a control group mean, with initial IQ's, Behavior Checklist scores, arithmetic achievement scores, and initial attending behaviors coVaried.

Baseline data was collected for approximately two weeks for each group. The treatment phase followed immediately for a period of three weeks. The investigator closely supervised each treatment process to insure its use as planned.

### Results

Differences in Levels of Attending Behavior Between Groups During the Baseline Period. It was hypothesized that there would be no statistically significant differences between group means during the baseline period. The null hypothesis was accepted at the .05 level of confidence. Differences approached, but did not reach significance when tested by the analysis of variance. The graphs of individual subject's levels of task-oriented, or attending behavior, show great variability during the baseline period.

Differences in Means of Attending Behavior Between the Baseline and Treatment Periods. Hypothesis 2 stated that no statistically significant differences would occur between the pre-treatment and treatment levels of attending behaviors in each experimental group. The paired t-test yielded differences for groups I and III which were

highly significant at the .01 level. The difference between the baseline and treatment means of group II just exceeded the difference required at the .05 level of significance. The null hypothesis was rejected for groups I, II and III, but accepted for groups IV and V.

Differences Between Treatment Means and the Control Mean of Attending Behaviors When Differences in IQ's are Covaried. Null hypothesis stated that there would be no statistically significant differences between the treatment means and that mean of the control group when initial intelligence differences among all subjects are covaried. The null hypothesis was rejected at the .01 level for groups I, II and III. It was accepted for group IV. From this test it was found that when the treatment means were adjusted to allow for the initial differences in intelligence quotients, the results were not altered in groups I, II, III, or IV, from the results yielded by the paired t-test of significant differences between baseline and treatment means.

Differences Between Treatment Group Means and the Control Group Mean of Attending Behavior When Initial Differences in Behavior Checklist Scores are Covaried. The null hypothesis was rejected at the .01 level for groups I, II and III. It was accepted for group IV. This result again supports the results of the paired t-test for significance of differences between baseline and treatment means.

Differences Between Treatment Group Means of Attending Behavior and that Mean of the Control Group, When Initial Differences in Arithmetic Computation Achievement Scores are Covaried. The null hypothesis stated that there would be no statistically significant differences. The null hypothesis was rejected for groups I, II, and III at the .01 level. It was accepted for group IV. When treatment means were adjusted for differences in achievement scores, the differences which obtained significance are the same as those that obtained significance when tested by the paired t-test for significance of differences between means.

Differences Between Treatment Group Means of Attending Behavior and that Mean of the Control Group, When Initial Differences in Attending Behaviors are Covaried. The null hypothesis stated that no significant differences would be obtained. The null hypothesis was rejected for groups I, II and III at the .01 level. It was accepted for group IV. The results of the study were not altered significantly when treatment means were adjusted for initial differences in baseline means.

#### Discussion and Conclusions Regarding Attending Behavior

The greatest difference between baseline and treatment means occurred in the group receiving the combined token reinforcement-programmed arithmetic treatment.

The advantages of the group III treatment became apparent during the course of the study. Token reinforcement by itself is an effective means of accelerating attending behaviors, as can be seen from the differences obtained by group I. The students involved in the study though, were, to varying degrees, deficient in arithmetic skills. Attention tended to wander from the assignment as they waited for assistance. Some of the subjects exhibited deviant behaviors as a reaction to frustration with an assignment. The most common deviant behaviors exhibited at such times were (1) playing with articles (pencils, rubber bands, rulers) in the desk, (2) making faces and gestures to a classmate, or (3) wandering about the room on the pretense of sharpening a pencil or looking for a paper. When programmed arithmetic was combined with token reinforcement, heightened motivation was directed toward materials that were not frustrating in level of difficulty. The students progress through the TMI Grolier program with very little assistance from the investigator. The students corrected their own responses, getting the intrinsic reinforcement of immediate knowledge of results.

The difference between the pre-treatment and treatment mean of group II, programmed arithmetic, although significant at the .05 level, was not as large as the difference obtained by group I and III. A survey of the graphs of subjects 1 and 2 in group II show great variability in levels of attending behavior. These subjects were in one classroom, while subjects 3 and 5 were in another. The daily arithmetic period of the class in which subjects 1 and 2 were enrolled

often involved arithmetic games, discussions, and blackboard work. The 2 experimental subjects' attention was distracted from the programmed arithmetic by the activities of the rest of the class. The experimenter asked the observer of the subjects to make a note describing the class activity at the time of each observation. The attending behavior of these subjects appeared to fluctuate with the type of activity that the majority of the class was involved in. When the activity was quiet seatwork, the programmed arithmetic held their attention at a high level. When it involved movement, or competition, it did not.

The difference between the baseline and treatment period means for group V, the control group, is in a negative direction. This result raised questions about the baseline period mean of the control group. The presence of the observers may have resulted in "Hawthorne effects" in the baseline data on the control group and the other four groups. This assumption, if true, would indicate that the mean difference figures for all groups are conservative ones.

The "Hawthorne effects" treatment given Group IV yielded positive though not statistically significant differences in means. The treatment served as a heightened "Hawthorne effects." The profiles of the levels of attending behavior of the subjects in that group show an increase during the beginning of the treatment period. The behavior of the subjects was apparently affected by the attention of the observers. As the study progressed, the per cent of attending behavior generally fell off toward baseline levels.

### Discussion and Conclusions Regarding Learning Rate Data

The graphs of that data show an increase in learning rate when the subjects used programed arithmetic materials. A ratio of the number of traditional problems completed to programed problems completed in a specified interval of time was established during a pilot study. The results illustrated in the graphs are misleading, since the ratio was based on time computations, of a uniform level of difficulty. During the baseline period, when the students of groups I and III were involved in the regular class math lesson, they worked on more advanced multiplication problems than were presented in the TMI Grolier program. Some assignments were short, so students worked at leisurely pace. The programed math allowed the students to begin to work immediately. They did not have to wait for instructions, or ask for help. The most important factor though, in accelerating the rate of computation was the relative simplicity of the programed material compared to the problems being assigned in the regular lessons during the baseline period. The graphs presenting the results must be interpreted with the above criticisms in mind.

Treatment strategies were planned that the investigator thought could be implemented by the teachers. The token reinforcement treatments, however, took too much time and attention for the teachers to use effectively. It was necessary for the investigator to take much of the responsibility of recording and dispensing the check marks, or tokens. The assistance of a counselor, resource teacher, or some other

supportive personnel would be necessary in applying the token reinforcement program as designed in this study.

### Summary

The purpose of this study was to evaluate the effectiveness of several treatment processes in (A) accelerating attending behaviors and (B) learning rate in behaviorally disruptive, underachieving fourth grade boys.

The token reinforcement treatment Group I produced differences statistically significant at the .01 level in the task-oriented behavior of the subjects in Group I. Data also show a rise in learning rate, or the number of problems completed correctly on different days in Group I and II.

The programmed arithmetic treatment Group II yielded changes in means of task-oriented behavior that were significant at the .05 level. Programed arithmetic appears to be less effective when there are competing stimuli within a classroom.

The token-reinforcement-programed learning treatment Group III was the most effective accelerator of task-oriented behavior. It combined an increase in motivation with materials that were mastered easily by the students.

The "Hawthorne effects" treatment did not result in statistically significant increases in task-oriented behavior. A brief rise in attending behavior was followed by a return to baseline levels.

### Limitations of the Study

The number of time-sample observations of the behavior obtained on each of the subjects is a limitation of the study. Observations were to take place during each subject's Arithmetic period. Teachers differed in the degree to which they adhered to a daily schedule. Several shifted their arithmetic periods occasionally to suit other activities during the school day. Some opportunities for observation were missed for this reason. The number of days absent from school also varied between subjects which also accounts for differences in the number of observations.

The learning rate results are another limitation of the study. The difficulty level of the programmed math and the regular arithmetic problems was so marked that the results are not as meaningful as the experimenter desired.

A second limitation of the study is the sample size. Time-sample observations are costly. They require many trips to the classroom of each individual subject. The cost of observer time limited the number of subjects that the experimenter could include in the study.

A third limitation of the study is that the system of token reinforcement, as designed, was too time-consuming to be carried out entirely by the classroom teacher. The experimenter had to play a more responsible role in the implementation of the token-reinforcement treatment strategy than was intended at the initiation of the study.

### Implications for Further Research

This type of study might be extended to the development of programs, based on reinforcement principles, that could be used efficiently by classroom teachers themselves. Economical systems of dispensing reinforcement, and of recording behaviors are certainly worthy of research.

During the baseline data collection period, it was noted by the investigator that the subjects under observation usually interacted primarily with one or two classmates. The classmate acted as the "audience" for the subjects' remarks or antics. Under the two treatments utilizing token reinforcement, the investigator, through casual observation only, noted the increase in attentive behavior of each subject's "audience." By systematically changing the behavior of each of the five most disruptive members of a class, it would appear that the behavior of a large part of a class might be effected. This question would seem to be worthy of investigation.

Programed learning materials may be differentially effective in different educational settings. The results of this study regarding learning rate are questionable. The advantages of programmed instruction, though, are apparent. The student can proceed on his own, at his own rate. The determination of the environment necessary for the most effective use of programed instruction also seems worthy of further study.

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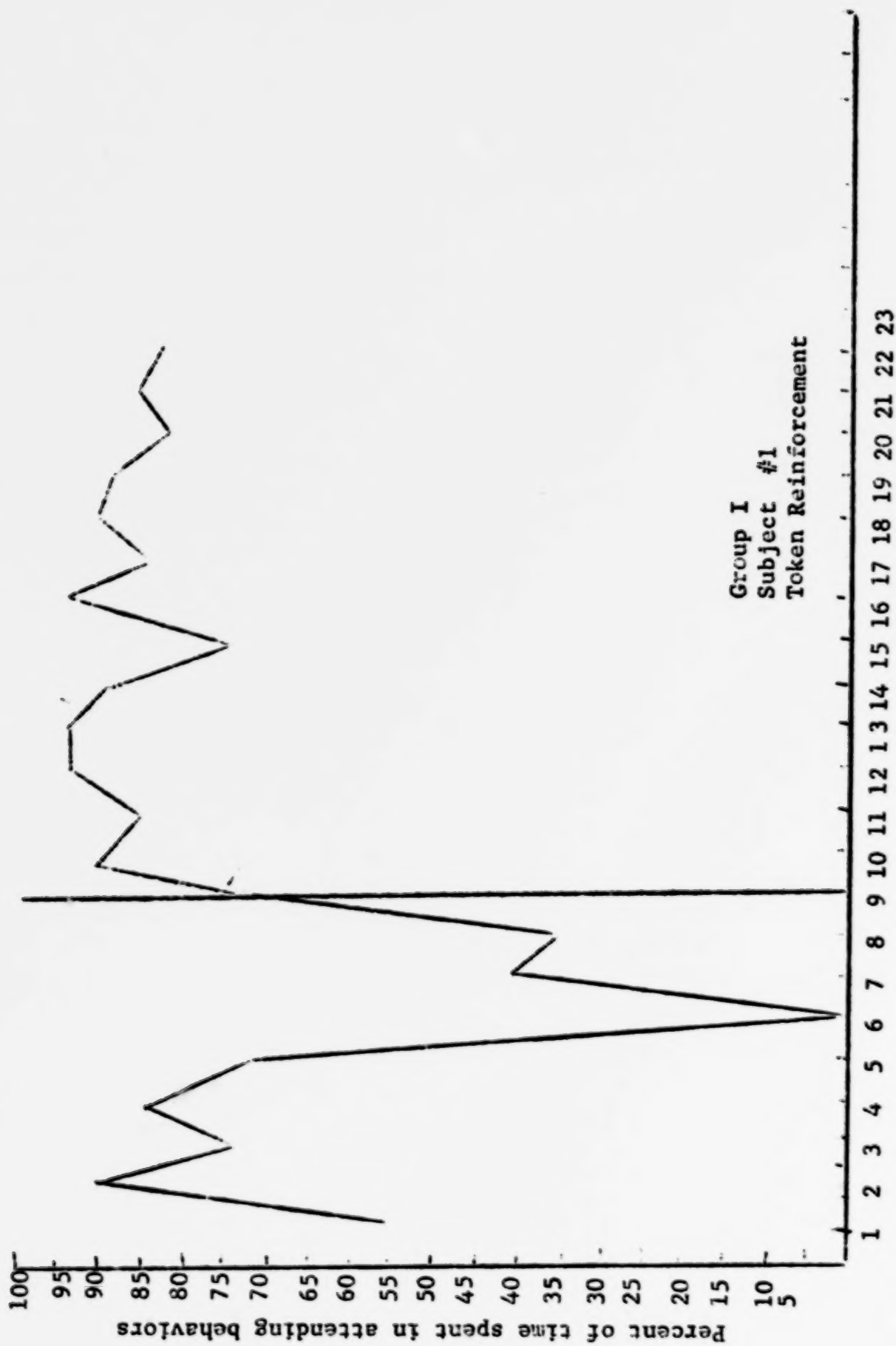
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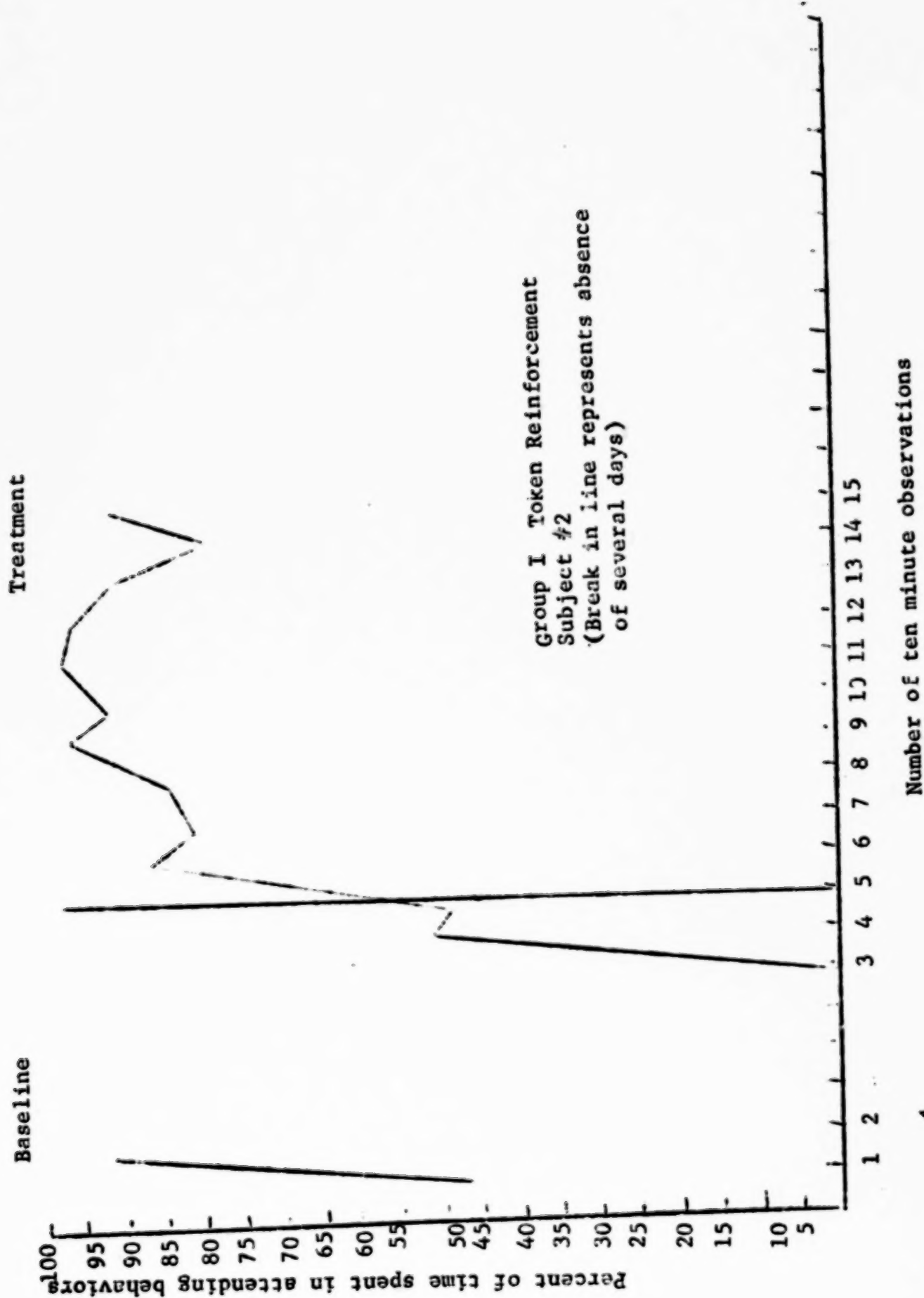
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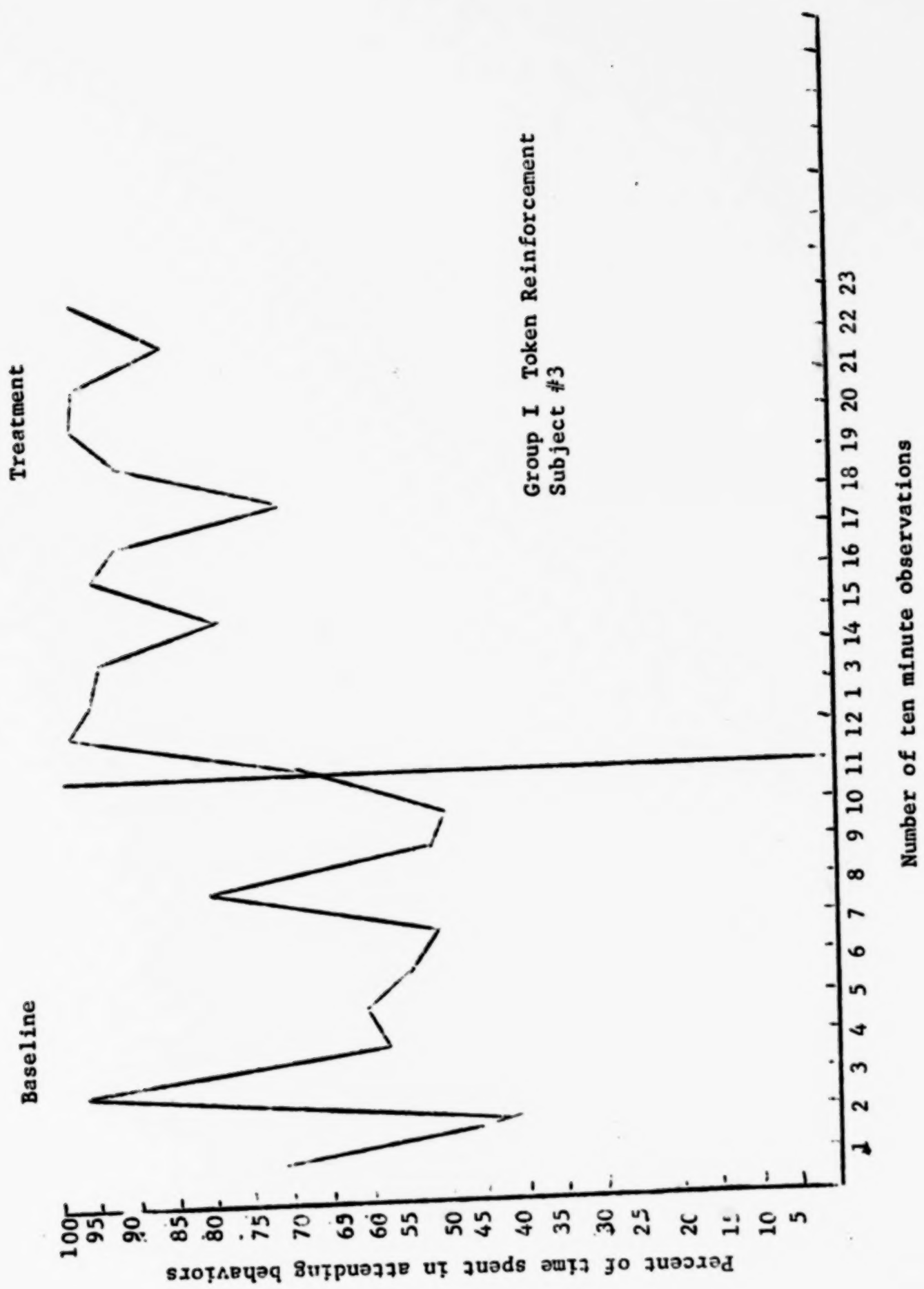
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Treatment

Baseline



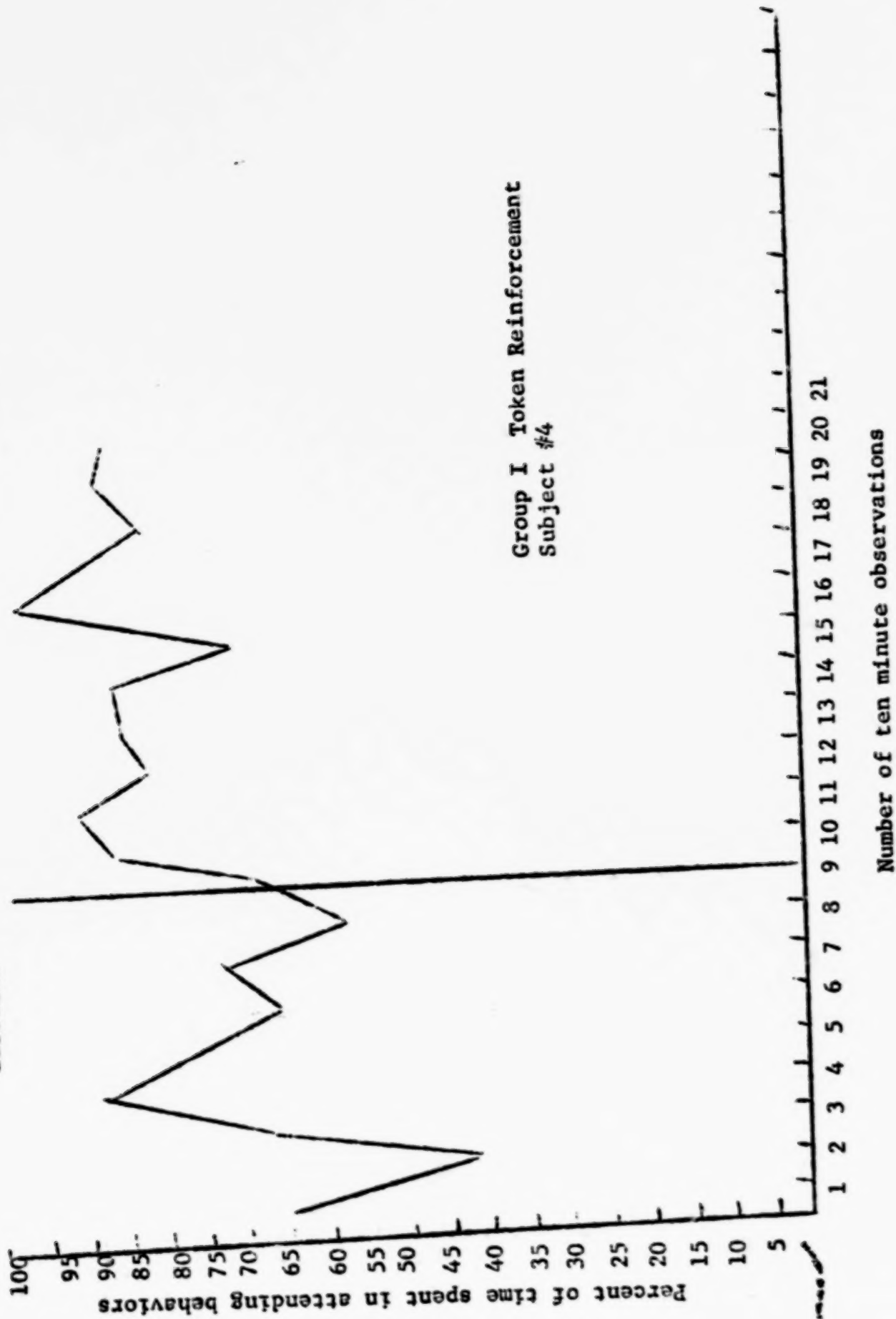


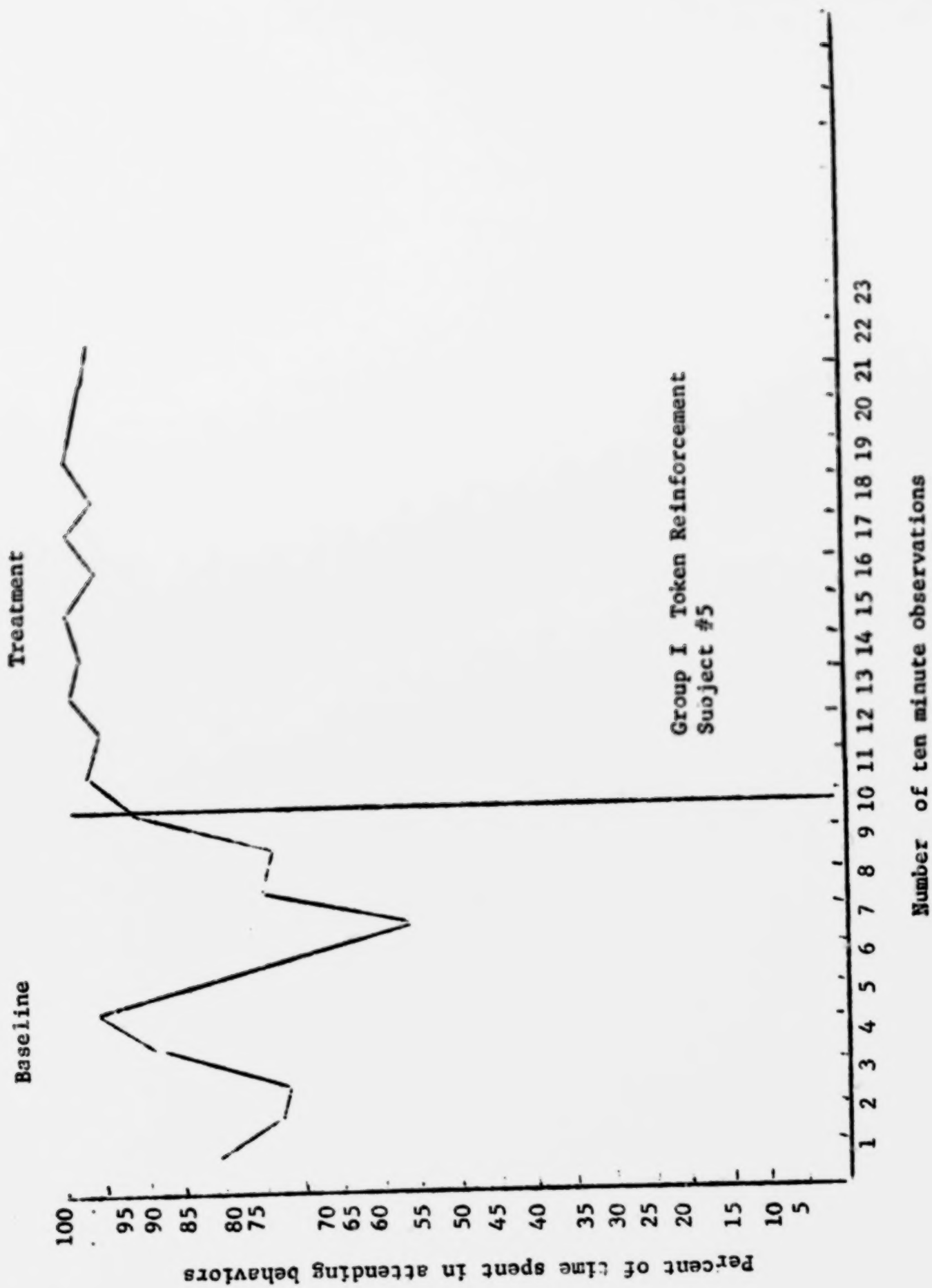


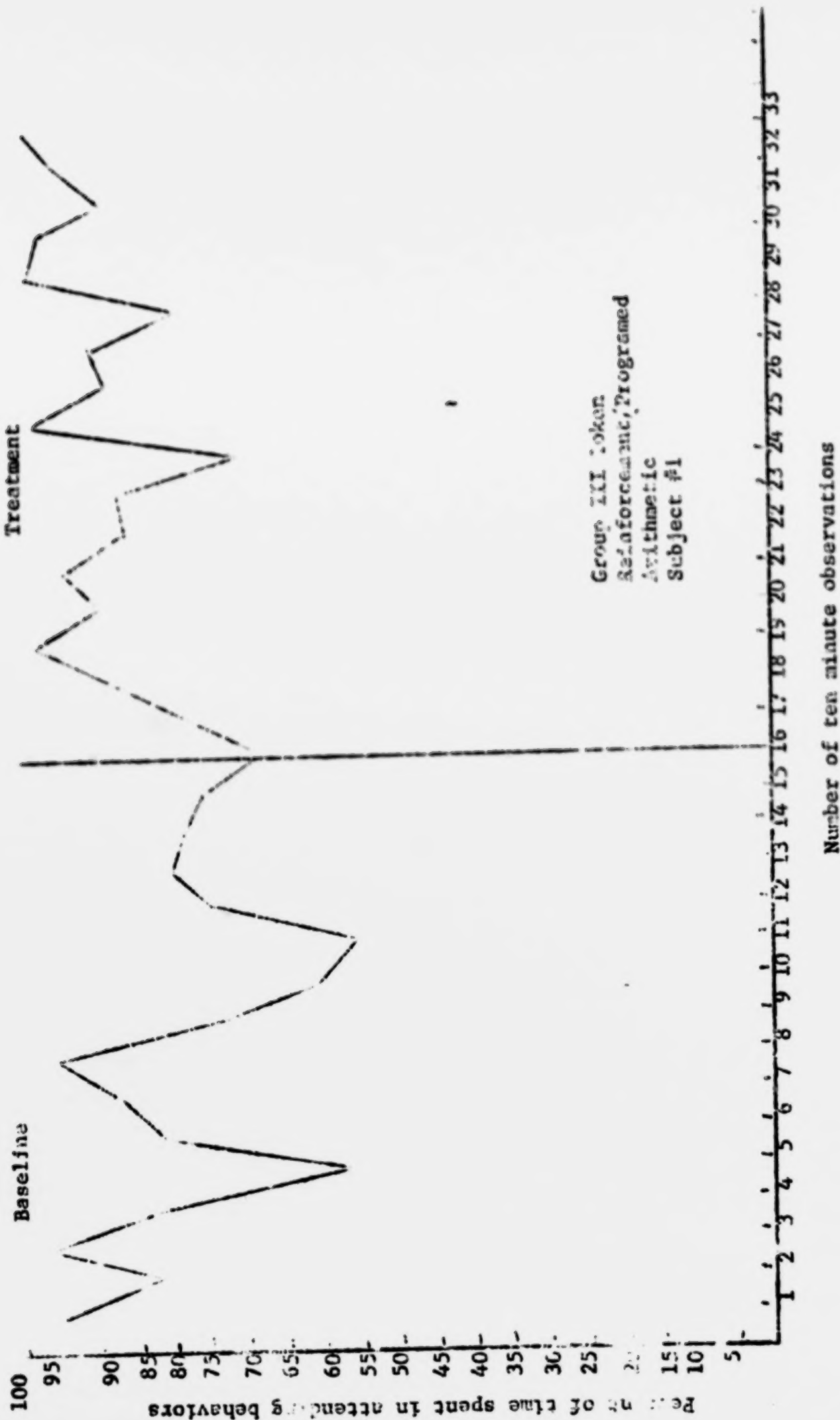
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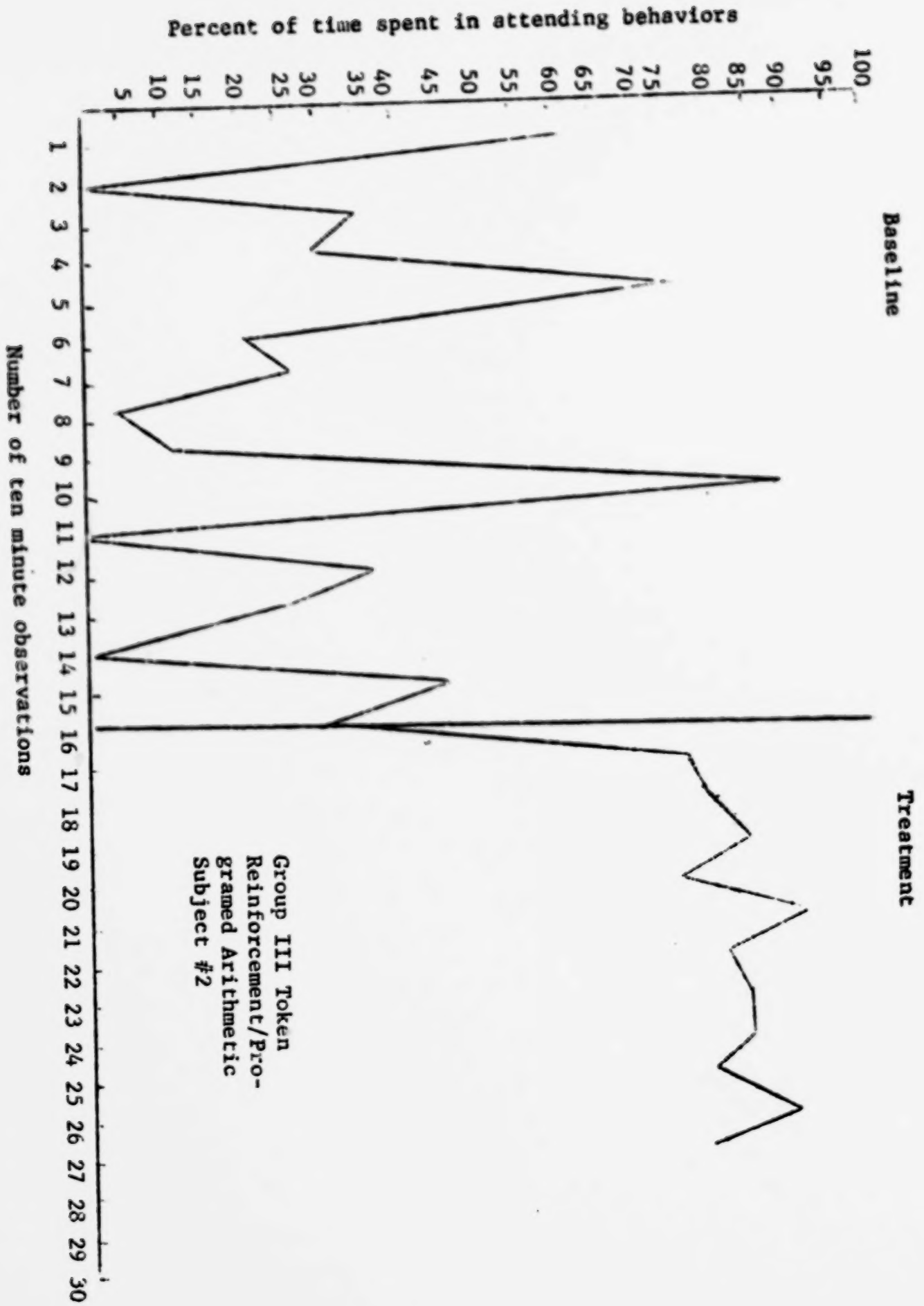
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Group I Token Reinforcement  
Subject #4



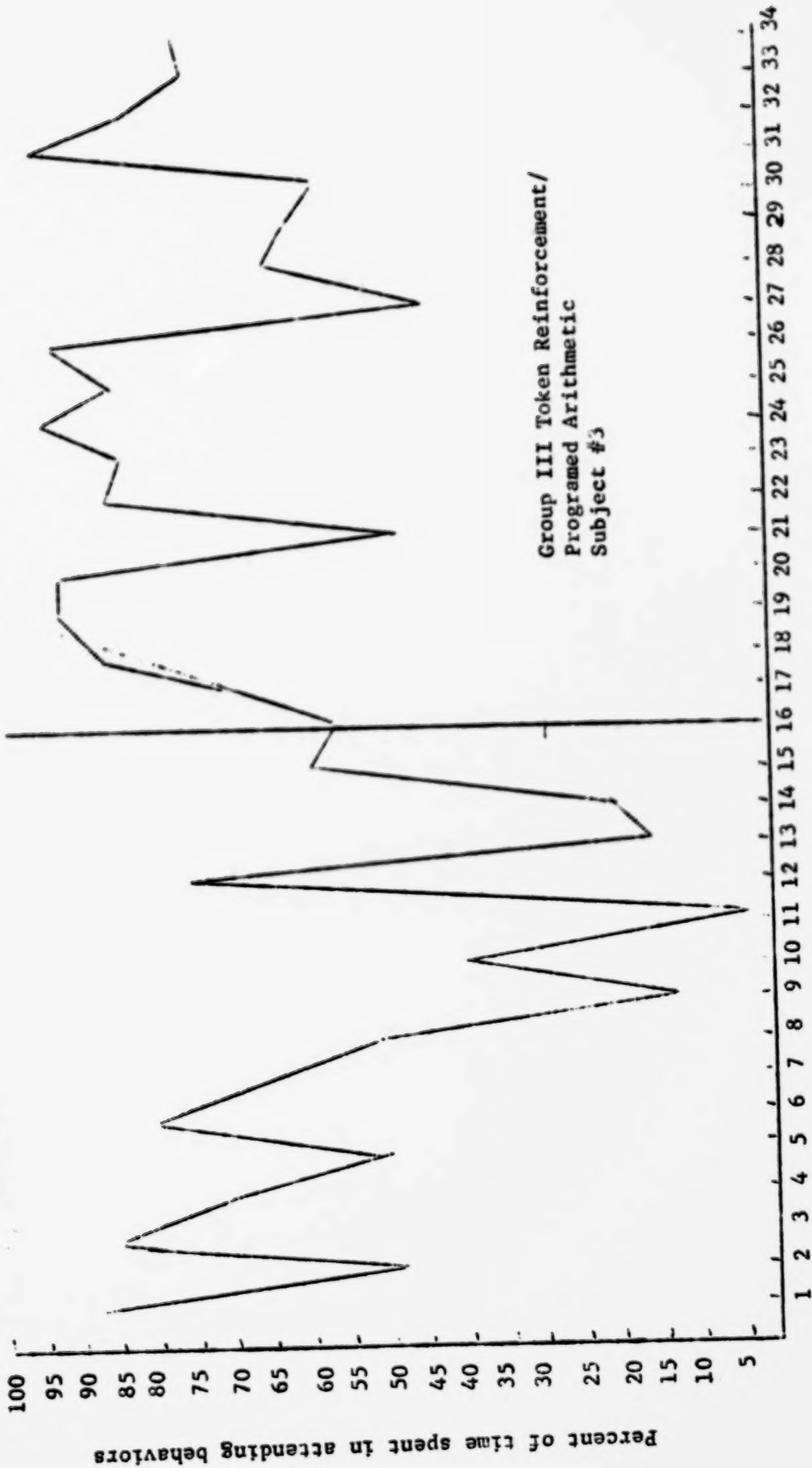


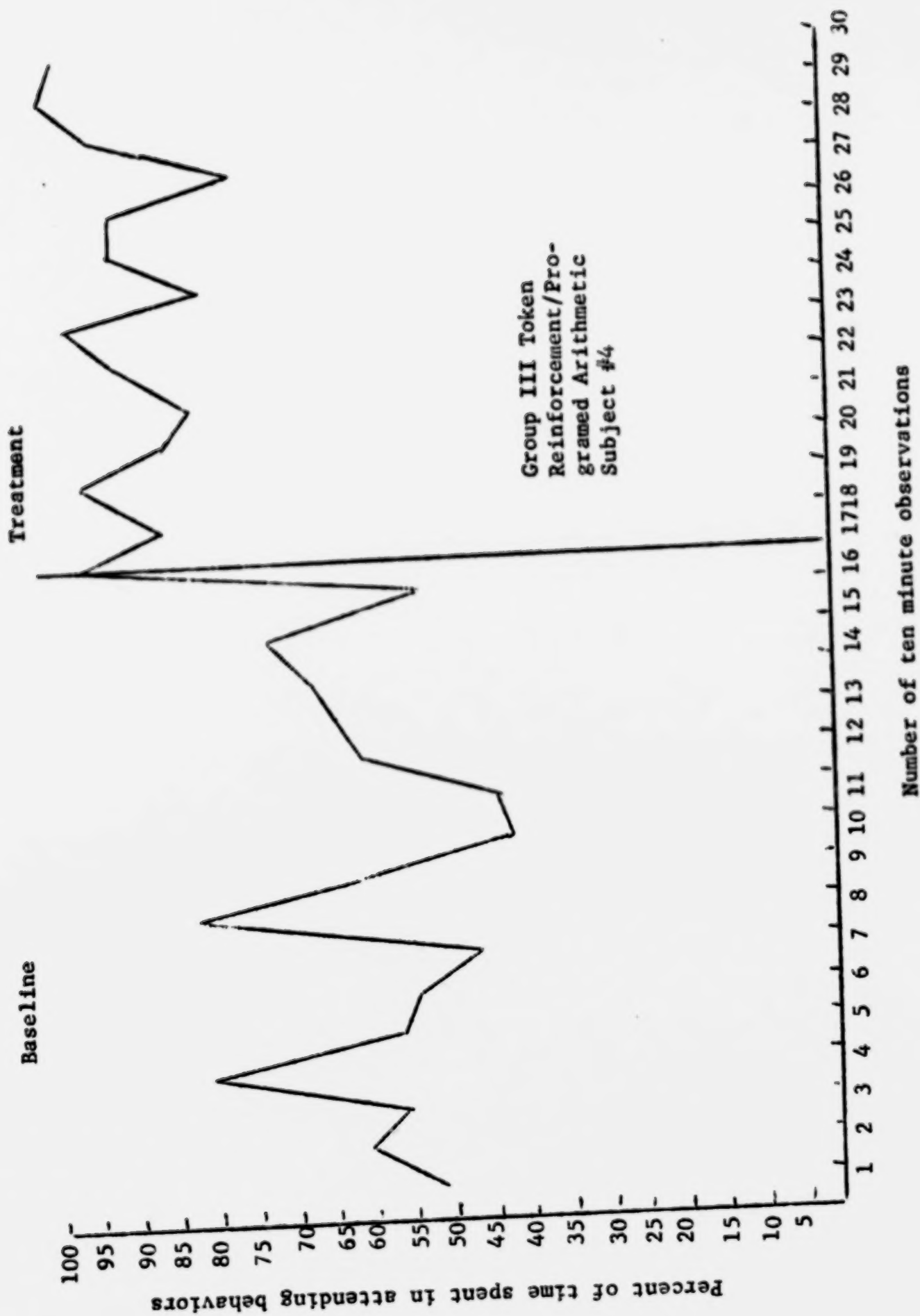


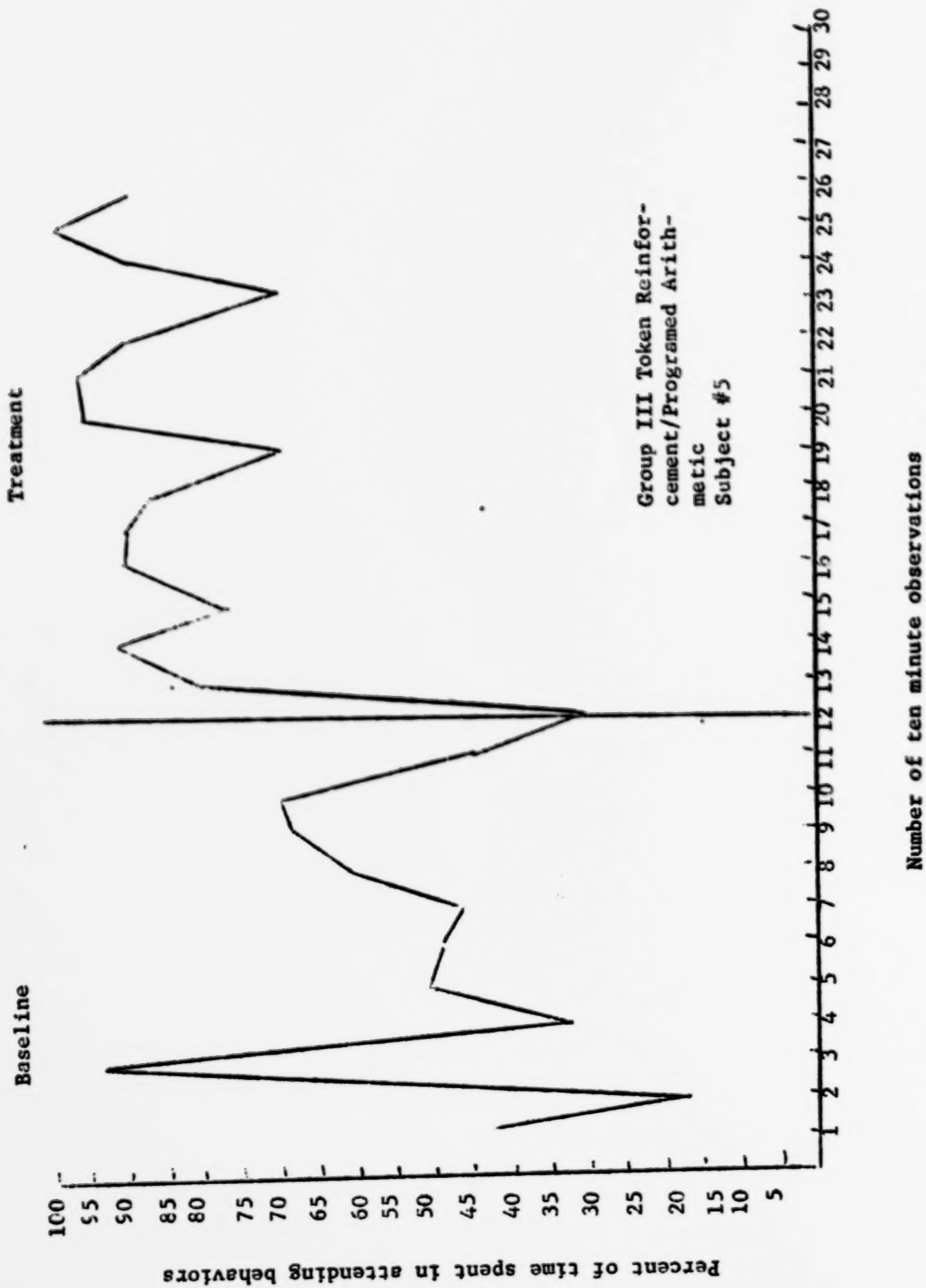


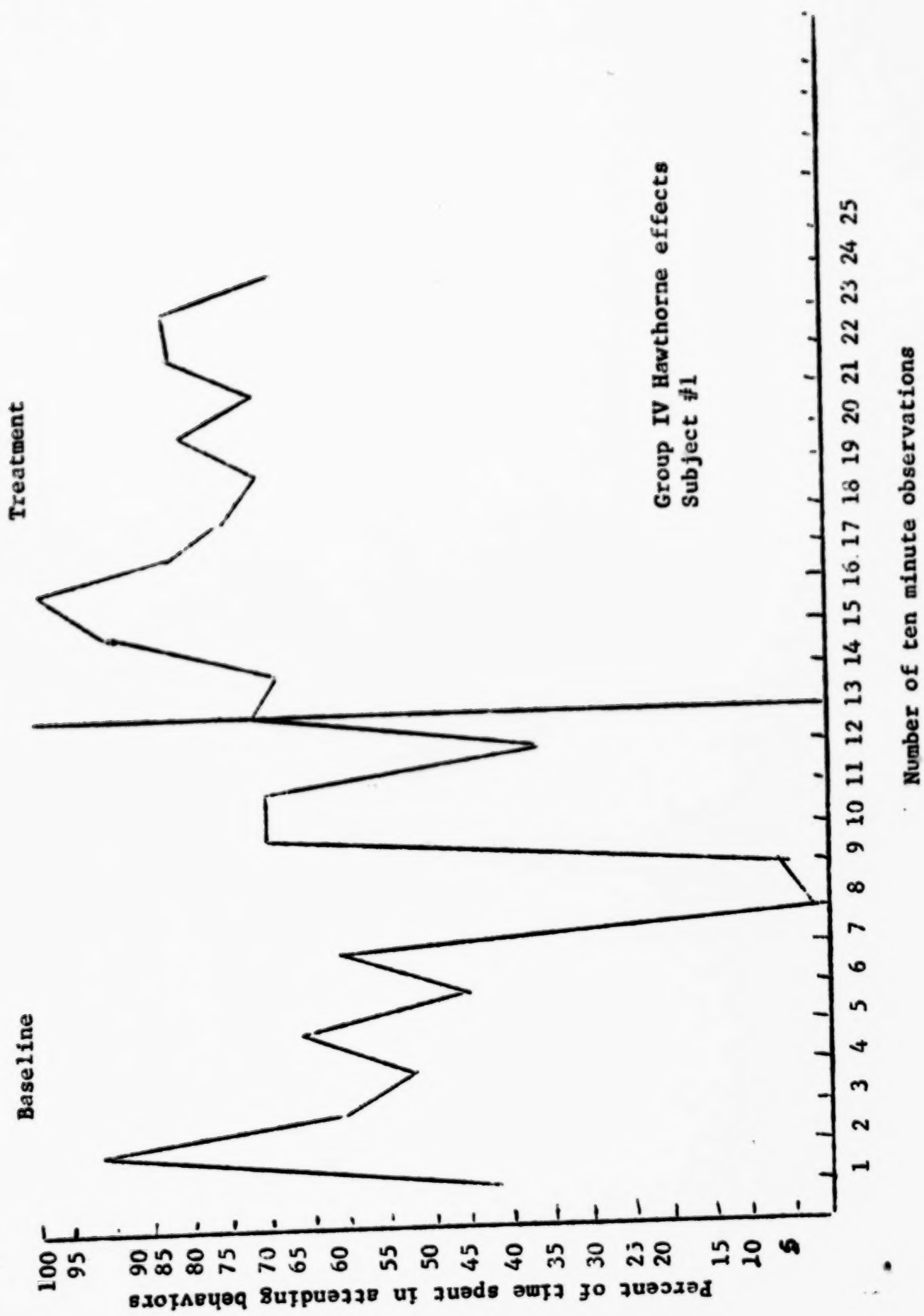
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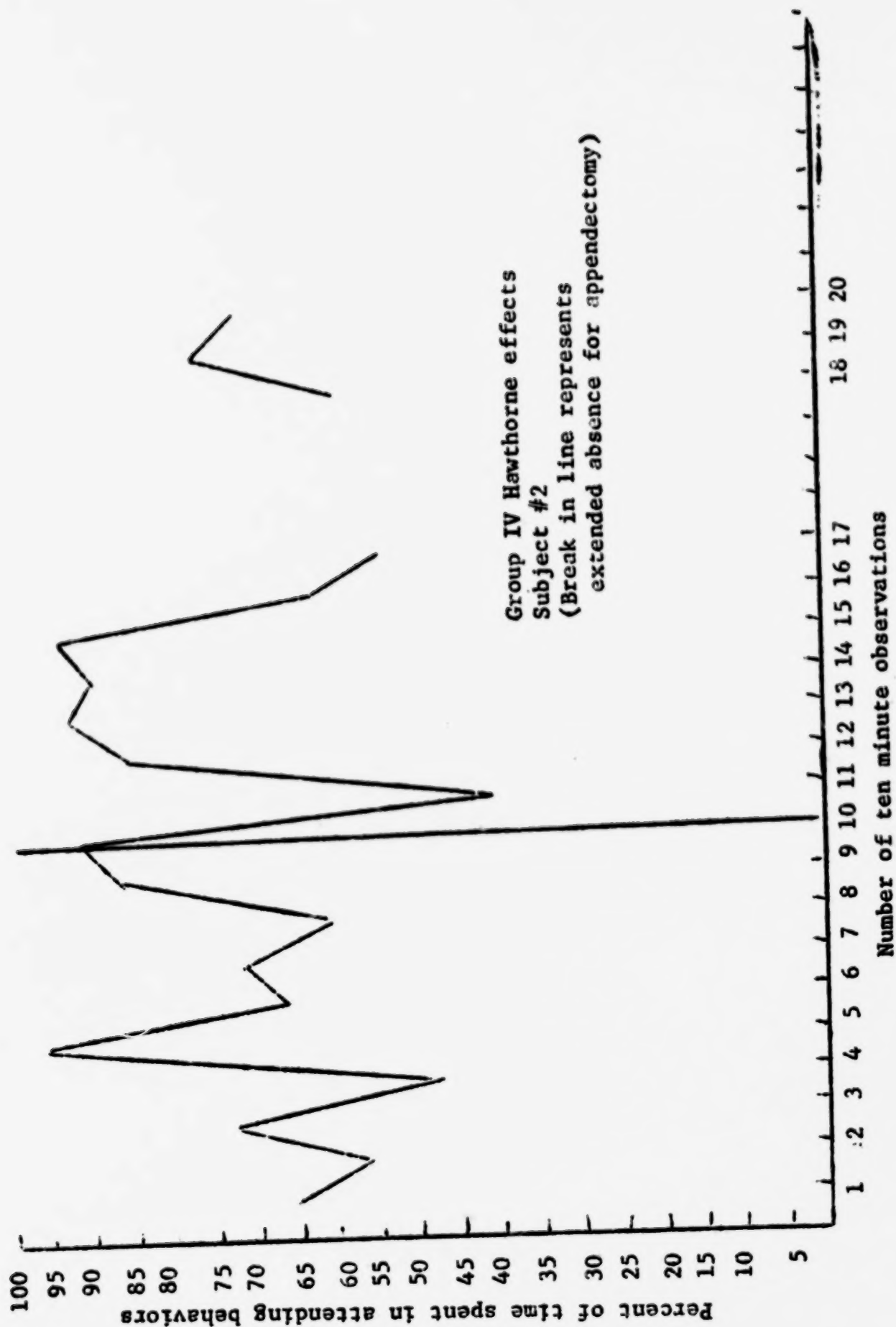


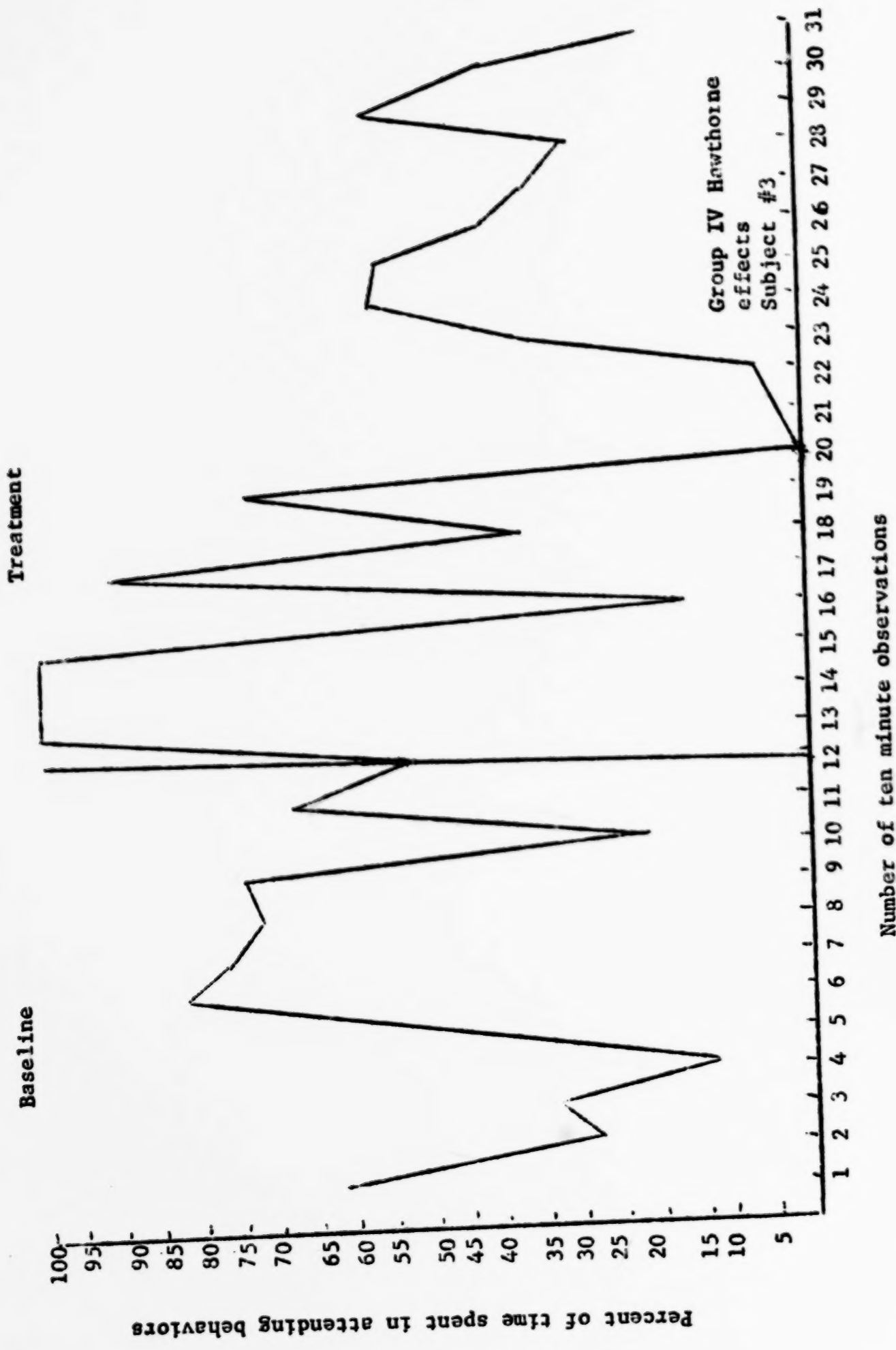




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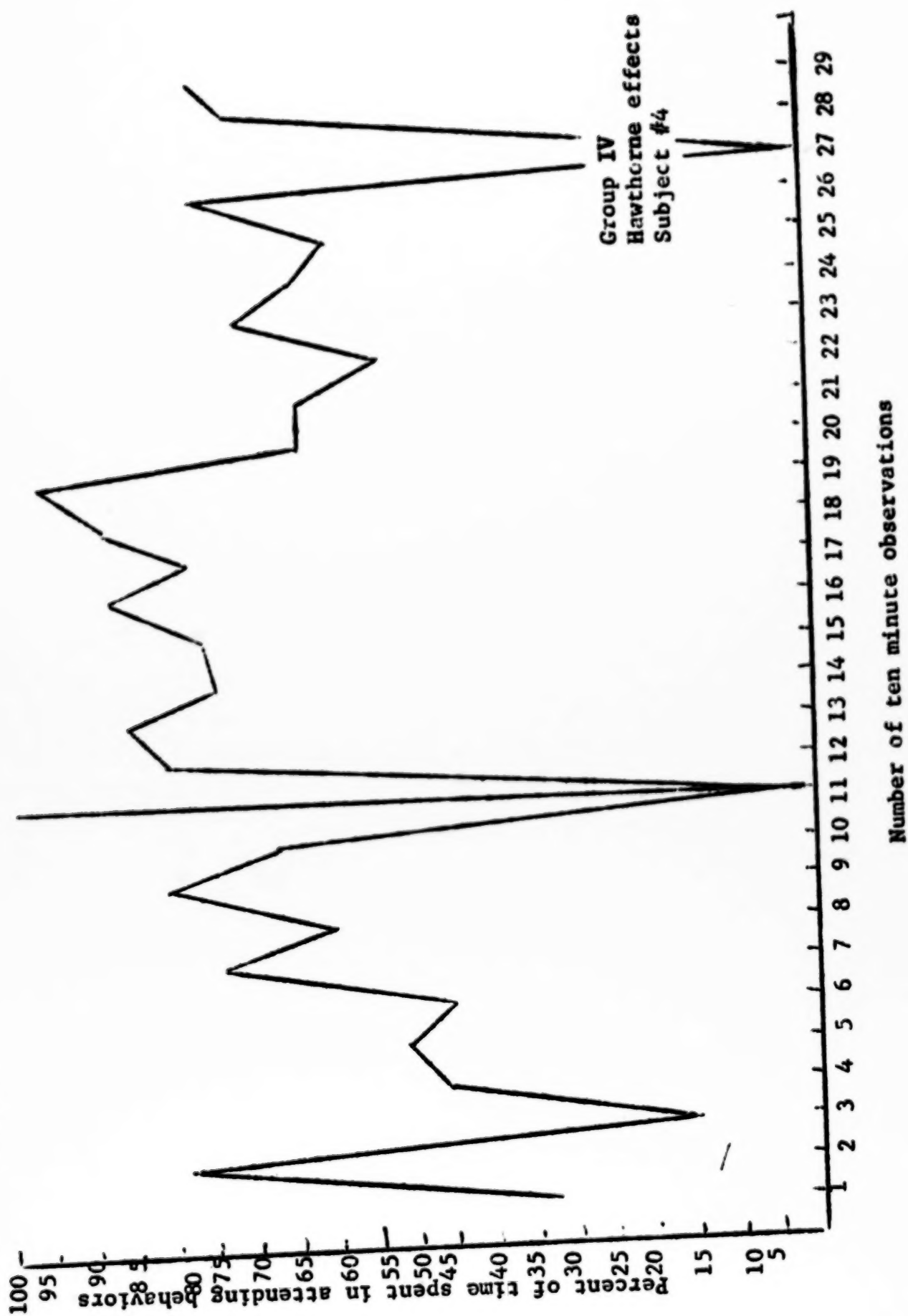
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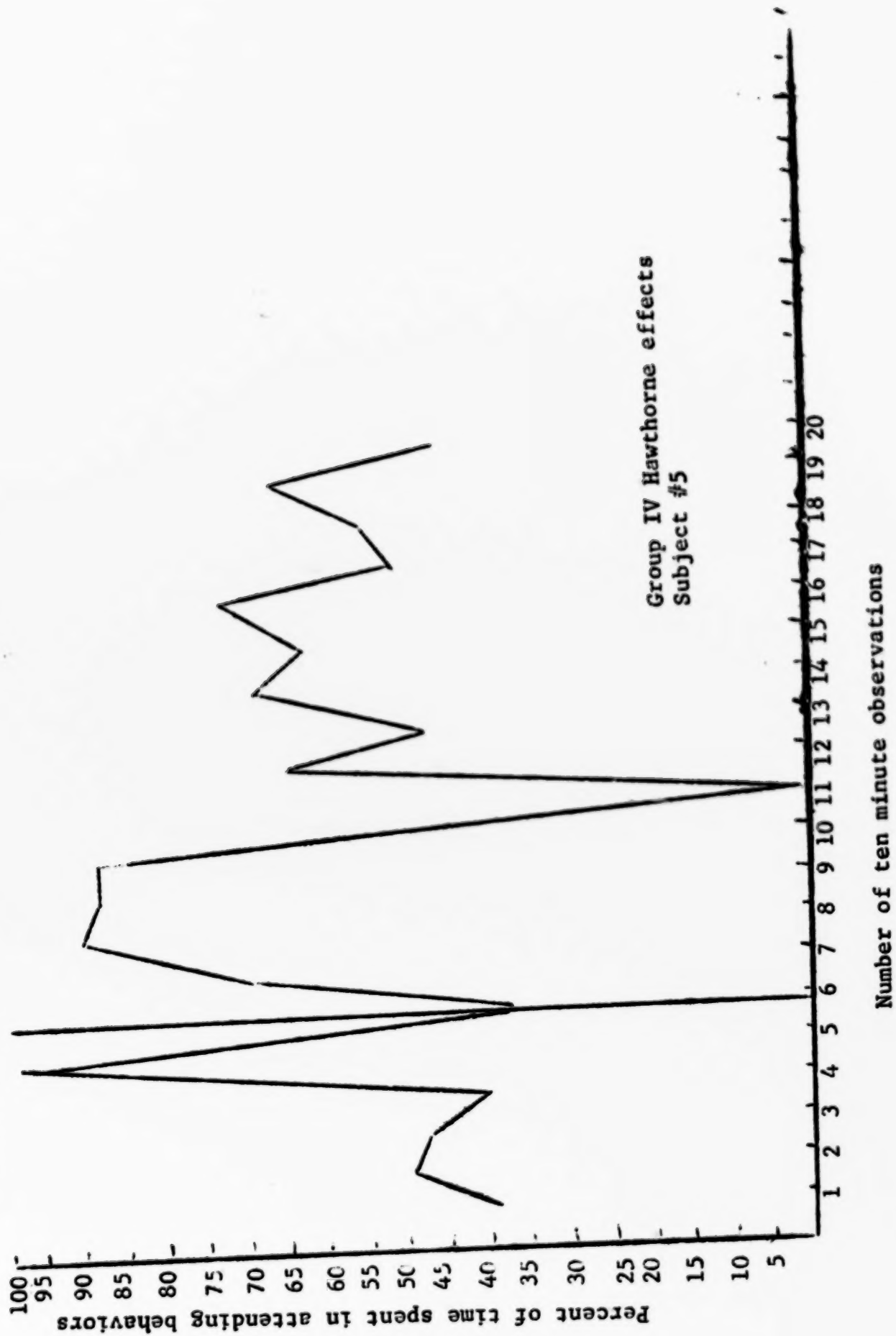
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Baseline



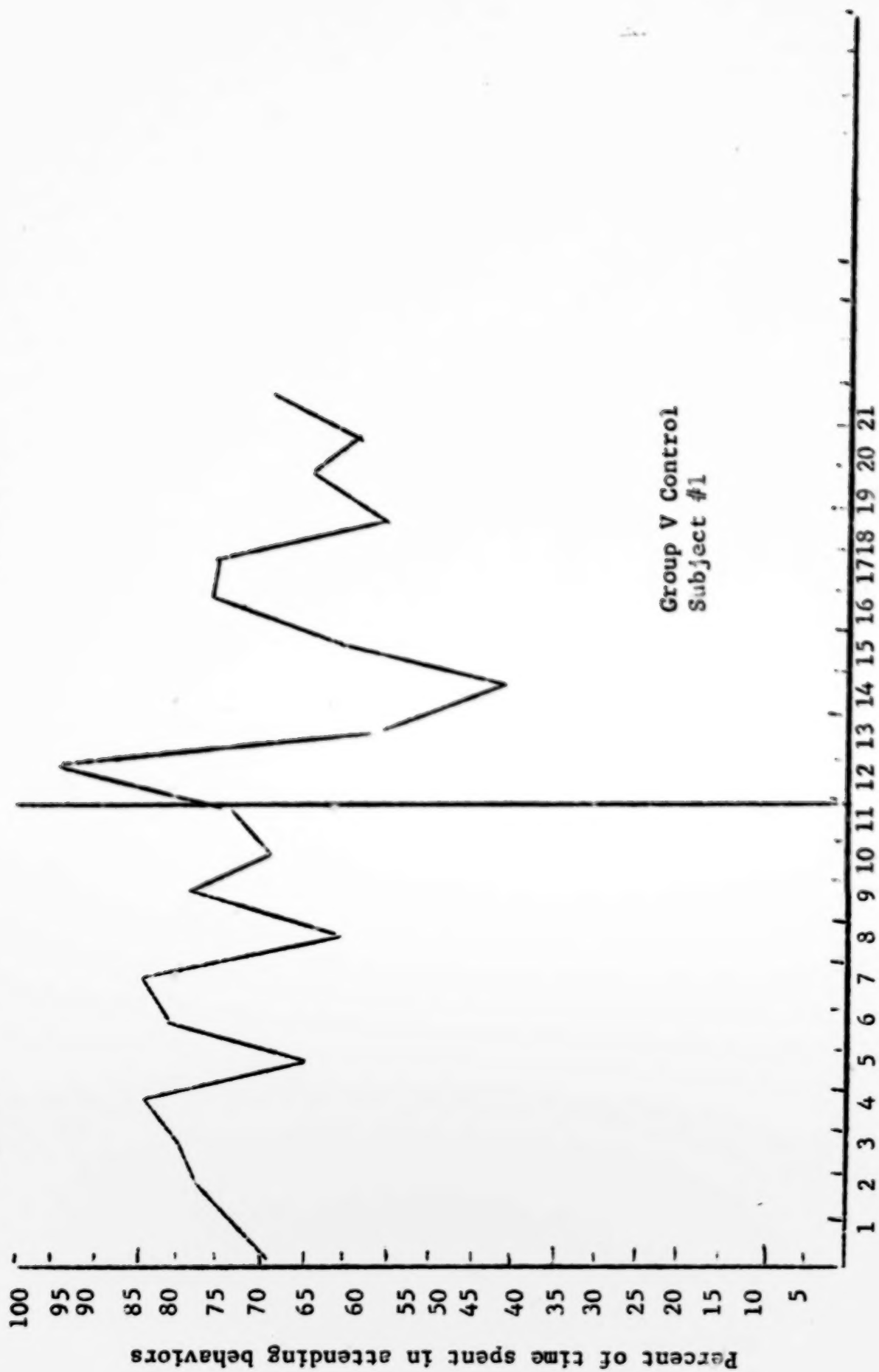
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Treatment

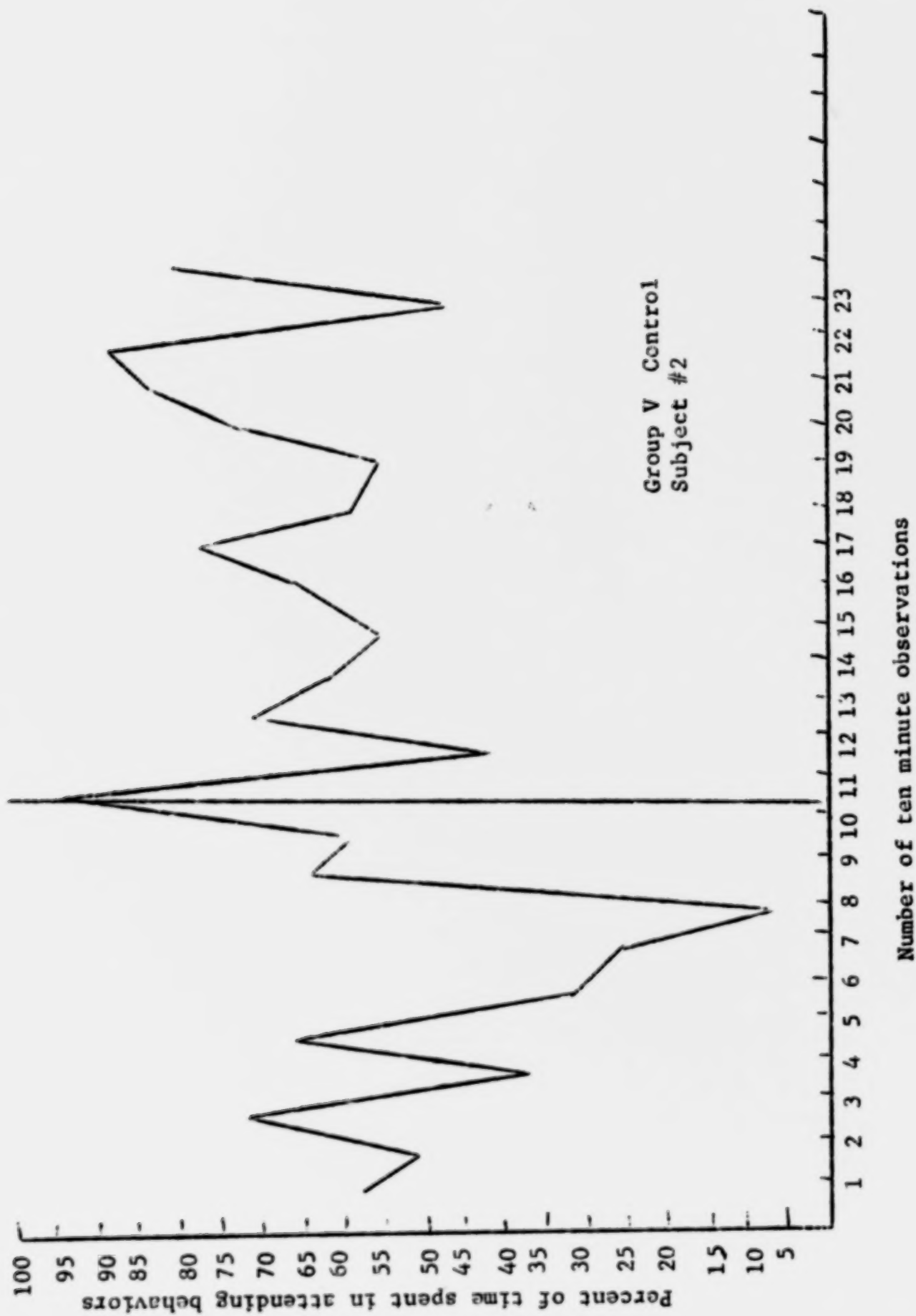
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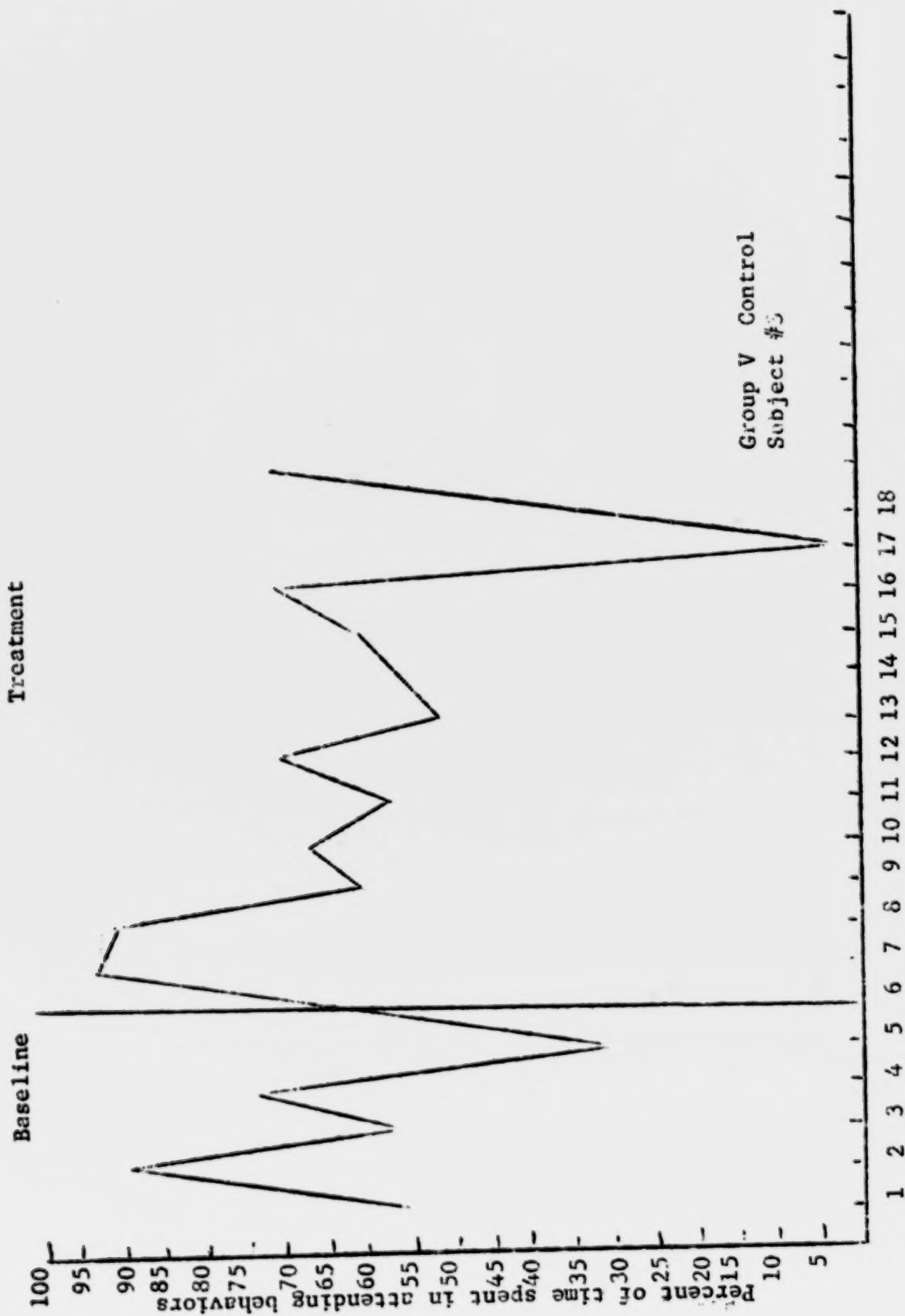


Number of ten minute observations

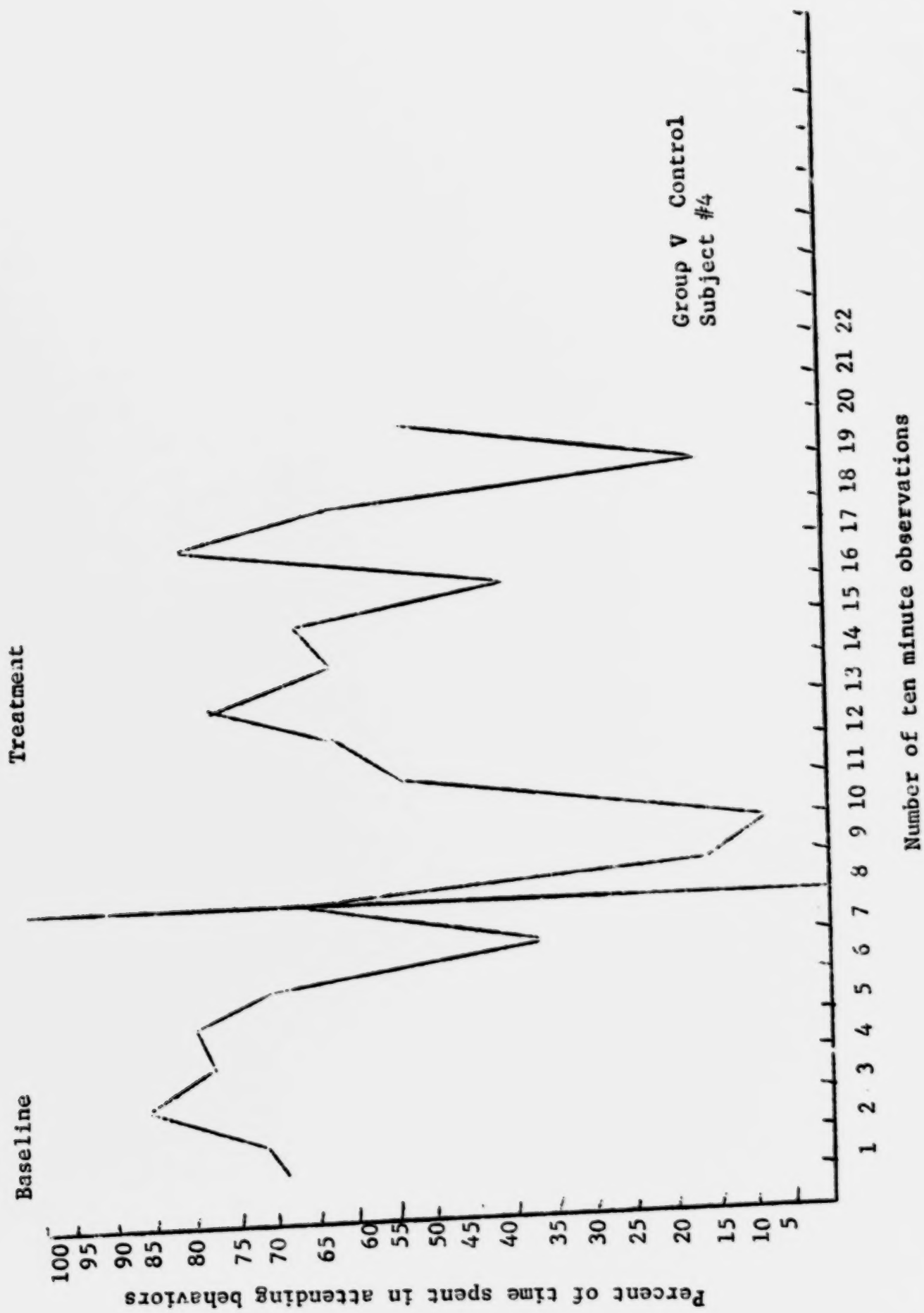
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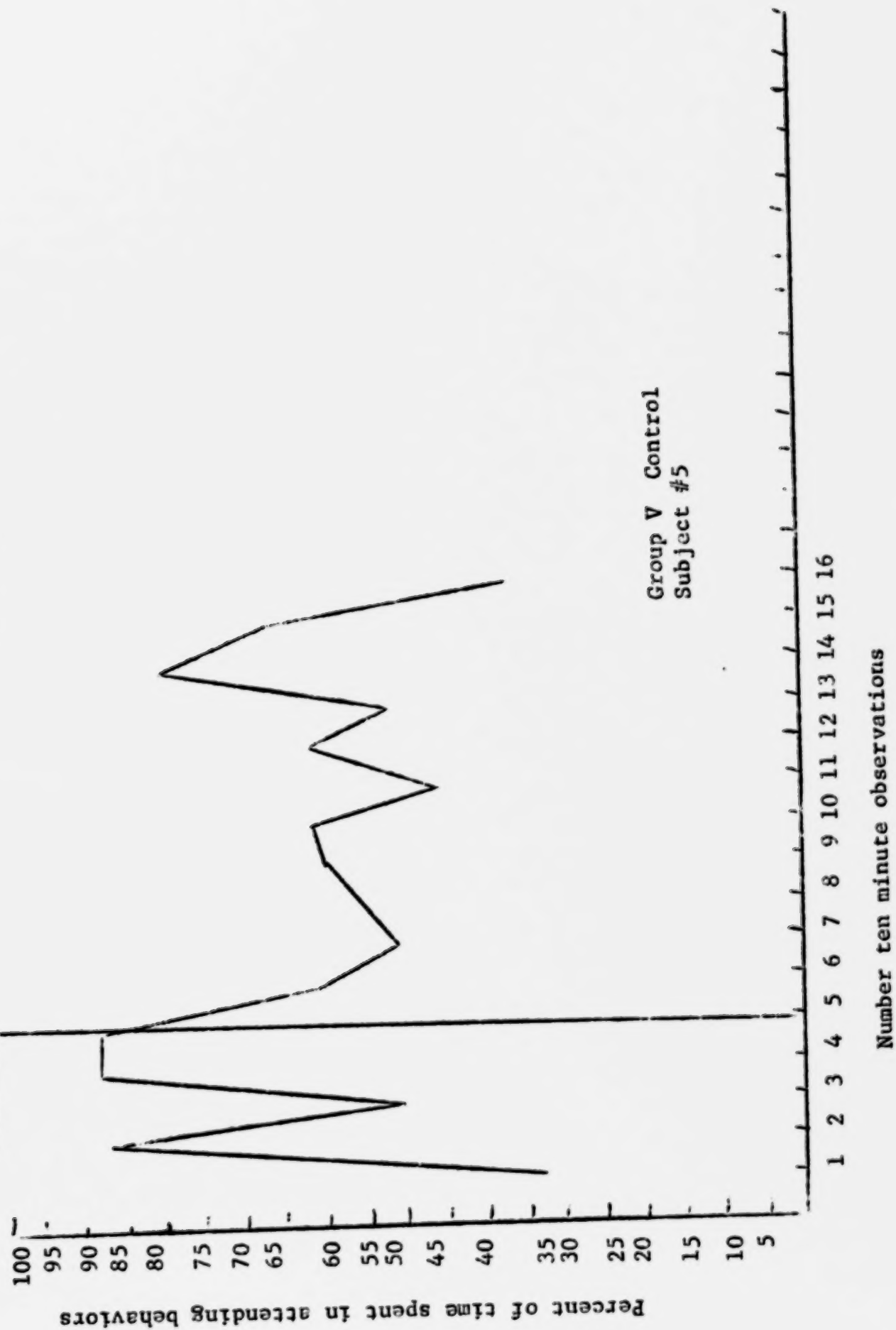
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Treatment

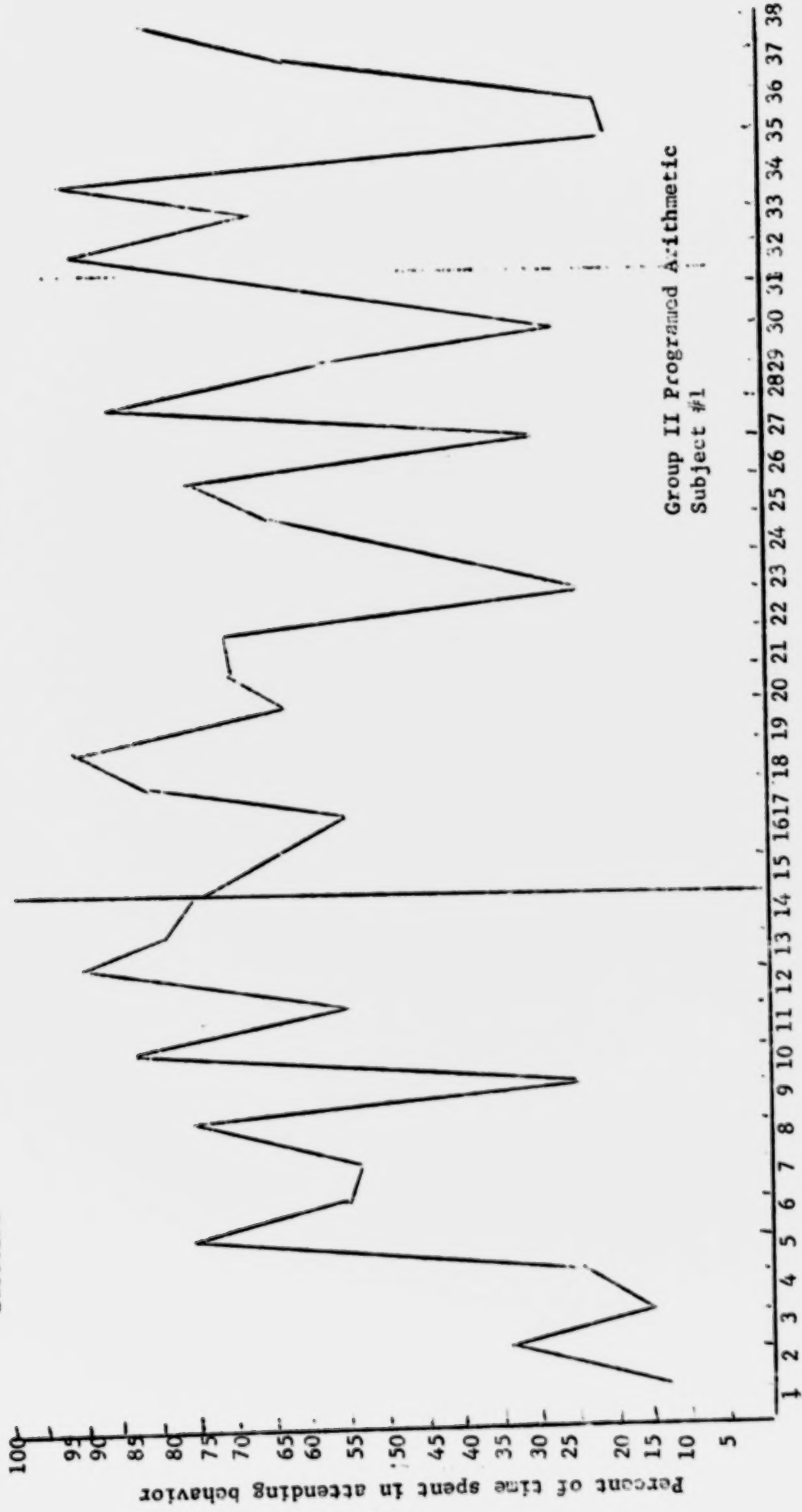
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Group V Control  
Subject #5



Treatment

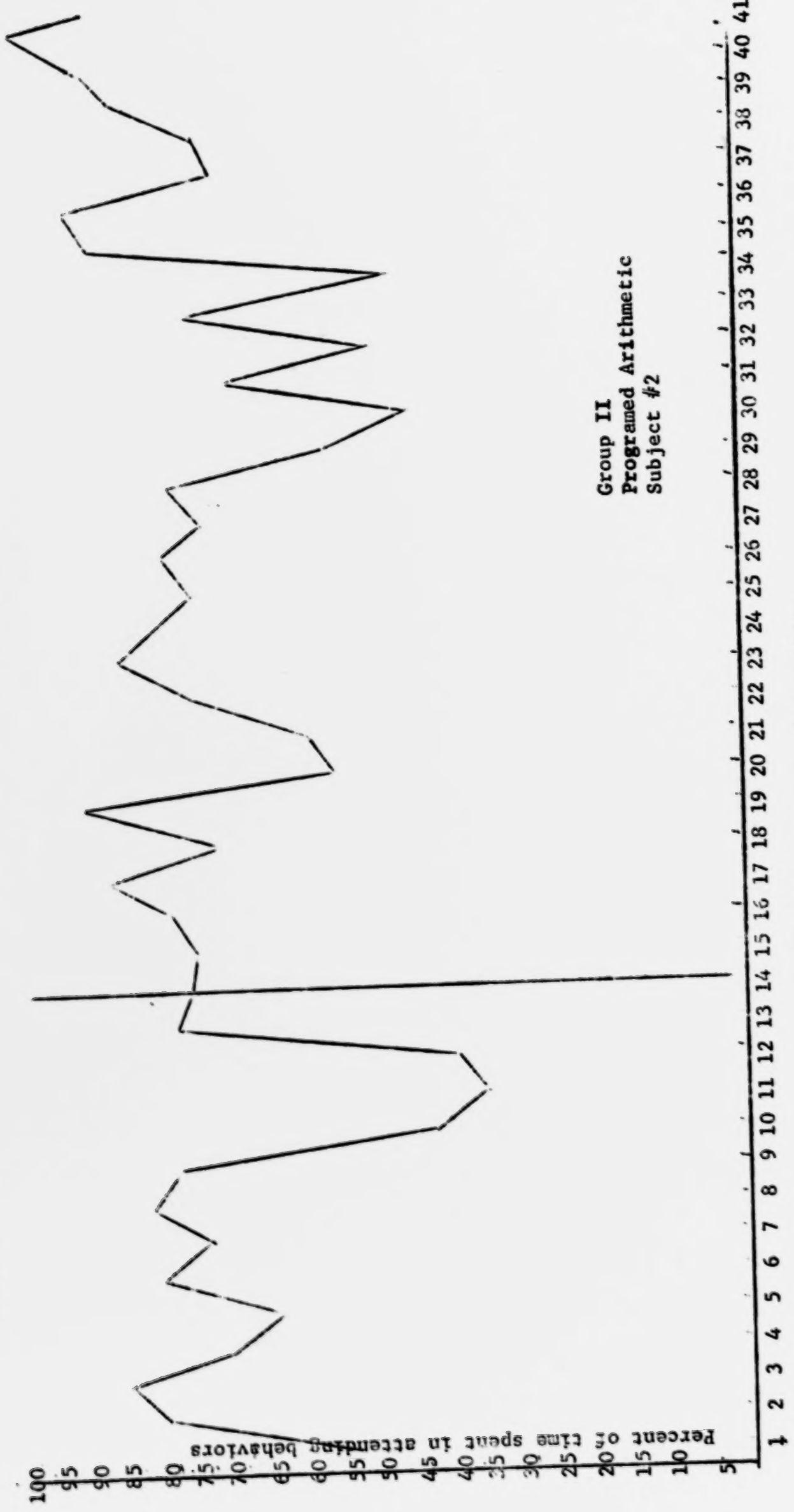
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Group II Programmed Arithmetic  
Subject #1

Treatment

Baseline

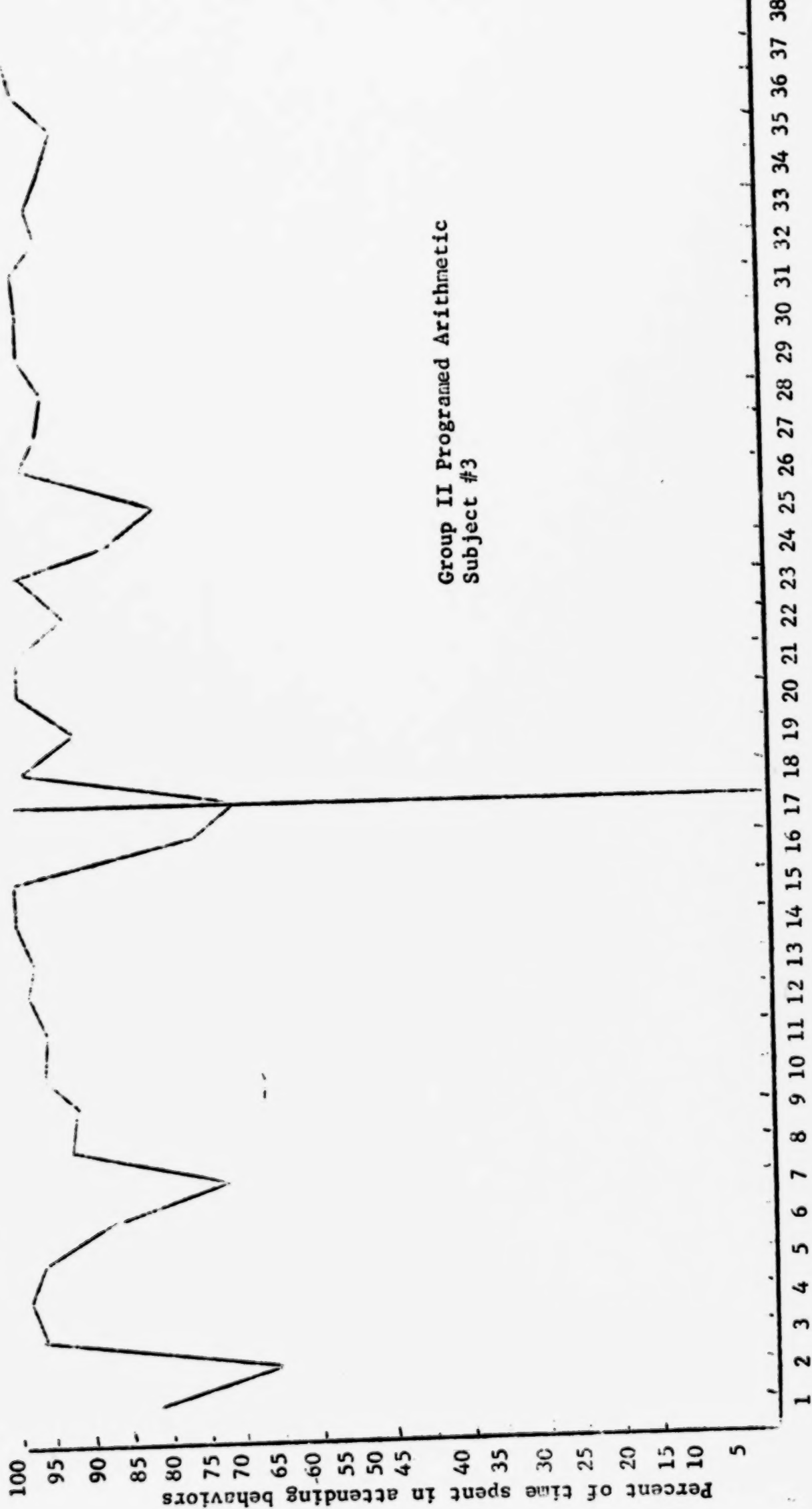


Group II  
Programed Arithmetic  
Subject #2

Number of ten minute observations

Treatment

Baseline



Group II Programmed Arithmetic  
Subject #3

Number of ten minute observations

